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of the World Literature on

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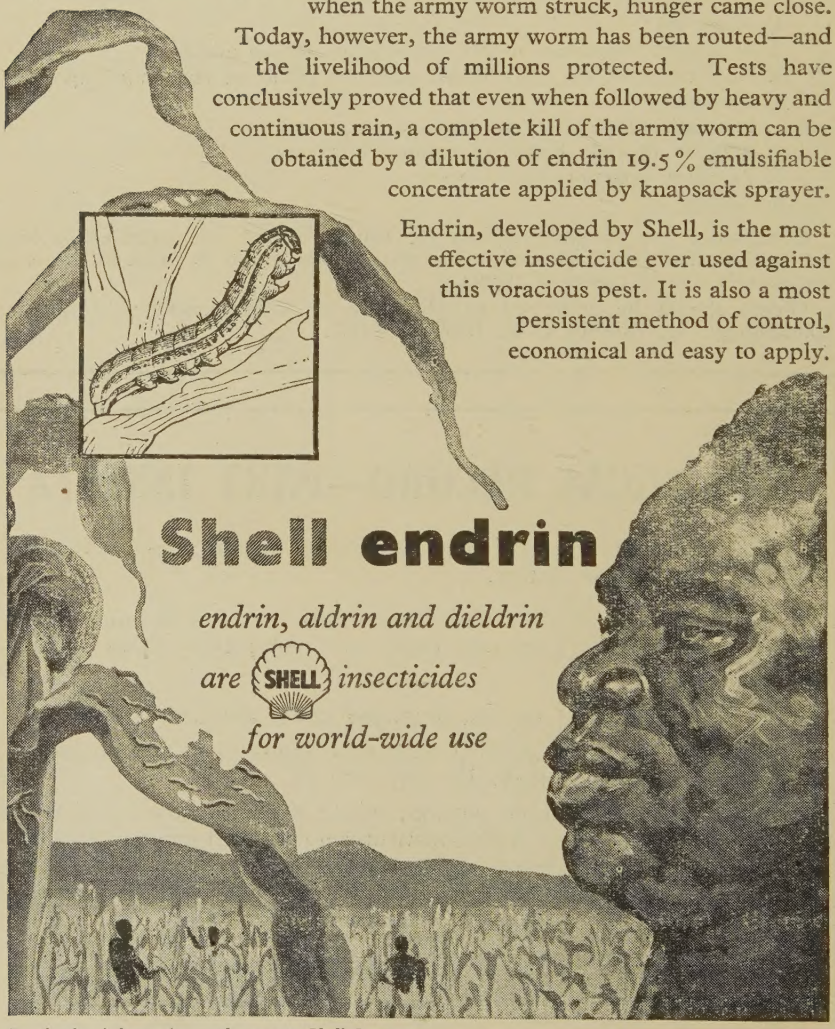

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Fjelddalen (J.). **Jordbaermjøllus** *Aleyrodes fragariae* **Walk.** [The Strawberry White-fly, *A. fragariae*.]—*Frukt og Baer* **8** pp. 17–21, 3 figs., 11 refs. Oslo, 1955. (With a Summary in English.)

An Aleyrodid that has injured strawberry plants in Norway since 1952 was identified as *Aleyrodes fragariae* Wlk., with which Ossiannilsson considers *A. lonicerae* Wlk. to be synonymous [*cf. R.A.E.*, A **29** 374]. In addition to strawberries, *A. fragariae* attacks black currant, *Lonicera periclymenum* and rose in Norway, and other food-plants have been recorded elsewhere. All stages are briefly described. Oviposition occurs on the lower surfaces of the leaves in early spring, and the nymphs hatch in about ten days and feed on the leaf sap, excreting honeydew. Observations in 1952–54 showed that there are three overlapping generations a year. The last was the most numerous, the nymphs feeding from late August to early October and the adults emerging in October and early November and overwintering. Sprays of DDT or parathion in early spring are recommended for control.

Nickerson (B.). **Pigmentation of Hoppers of the Desert Locust** (*Schistocerca gregaria* **Forskål) in Relation to Phase Coloration.**—*Anti-Locust Bull.* no. 24, [2+] 34 pp., 7 figs., 52 refs. London, 1956.

The following is virtually the author's summary. A review of the literature on locust pigmentation shows that little is known of the histology of individual pigments or of the physiological mechanism involved in their deposition. The present work is concerned with these aspects. The spatial distribution in the integument of hoppers of *Schistocerca gregaria* (Forsk.) of melanin, insectorubin, insectoverdin and β-carotene was investigated for laboratory-reared hoppers in phases *gregaria*, *transiens* and *solitaria*. The close association of pattern and background pigments and their continuous nature throughout the species are described, and the effects of temperature, starvation and varying quality of food on the coloration of hoppers are shown to be related to the change in distribution of the pigments.

Before the physiological mechanism could be investigated, it was necessary to show that the colour of a given hopper remained stable during the experimental period and to obtain some criteria of the degree of colour change that could be expected to be induced by experimental techniques during that time. From varying-density experiments, the degree of phase reversal under normal conditions was obtained. The experimental techniques utilised to induce colour changes were those of grafting, implantation and blood injections; changes in pigmentation in experimental hoppers were compared with non-treated controls and the phase-change criteria. Results suggest that coloration is governed by a humoral control system, phase *gregaria* blood containing a factor capable of inducing changes in the pigmentation of hoppers in phases *transiens* and *solitaria* and producing coloration of the gregarious type. The activity of this factor is influenced by its concentration and the physiological state of the recipient tissues. The chemical properties of the factor suggest it to be a steroid, though no conclusive proof could be obtained either by blood analysis or injection of synthetic hormones.

The inability to alter the pigmentation of phase *gregaria* by the experimental techniques is discussed, and a hypothesis on the mode of action of the humoral system is advanced. The experimental results are best explained by assuming two hormones, controlling pattern and background

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pigmentation, respectively, the integrated activity of which results in the visible coloration.

DAVATCHI (A.). **Sur quelques insectes nuisibles au pistachier en Iran. I. Hymenoptera-Chalcidoidea.**—*Rev. Path. vég.* **35** fasc. 1 pp. 17–26, 10 figs., 6 refs. Paris, 1956.

Pistachio (*Pistacia vera*) is intensively cultivated in parts of Persia but is severely attacked by insects [*cf. R.A.E.*, A **36** 385], including *Eurytoma plotnikovi* Nikol'skaya and *Megastigmus pistaciae* Wlk., of which *M. ballestrerii* (Rond.) [*cf.* **27** 452] is a synonym. The adults of both sexes of *E. plotnikovi* are described, and its distribution is reviewed. Observations showed that the larvae overwinter in the last instar within the fruits, in which they pupate from late April onwards. Adults were present from early May, maximum numbers emerging about 20th May. Of 260 that emerged in the laboratory, only six were males. The females laid their eggs, usually singly, in the skin of the fruits and the larvae fed externally on the kernels, which continued to develop. Only one larva was observed per fruit. Development was slow, being interrupted in winter and resumed in March, after which the kernels were completely destroyed. In some years, losses amount to over 50 per cent. of the crop.

Descriptions are given of the larva and adult female of *M. pistaciae*, no males of which were observed, and its distribution is reviewed. There were two generations a year. The larvae overwintered in the last instar in the fruits and pupated about the time of flowering, from early April. The pupal stage lasted about two weeks, and the adults emerged between mid-April and late May. The eggs were laid at the rate of 1–2 per fruit, and the larvae immediately entered the kernels, on which they fed for 35–40 days. They pupated within the endocarp, which they did not damage during feeding, and the first-generation adults emerged after about 12 days, the first being observed about mid-June. The females oviposited after 3–5 days; those that emerged late were unable to lay eggs as they could not pierce the hardened mesocarp [*cf.* **7** 87]. The larvae fed on the kernels and overwintered. *M. pistaciae* was found in association with *E. plotnikovi*, but was usually less numerous, possibly because many of the summer adults emerged too late to oviposit. The collection and destruction of infested fruits is recommended for control of both species.

GALICHET (P. F.). **Quelques facteurs de réduction naturelle dans une population de** *Dysdercus superstitiosus* **Fab. (Hemiptera, Pyrrhocoridae).** —*Rev. Path. vég.* **35** fasc. 1 pp. 27–49, 3 figs., 34 refs. Paris, 1956.

The author reviews the literature on the bionomics and ecology of *Dysdercus* spp. in Africa and gives an account of observations on a population of *D. superstitiosus* (F.) in the Ivory Coast, carried out in March–June 1950 in a plot of about $\frac{3}{4}$ acre cleared in tropical rain forest in February of that year. Of the 24 trees left standing, 19 were coconut and one was *Ceiba thonningii*, which was in fruit and the only malvaceous plant present. There was no cotton in the area. Frequent counts were made of the numbers of *Dysdercus* in the plot or, when the undergrowth became dense, on the paths bordering it, and the results are shown in a table and graph, together with details of temperature, relative humidity and rainfall. Few individuals were observed at the beginning of the study, and almost all were adults. The numbers increased steadily thereafter, apparently as a result of migration from adjacent areas, and reached a peak in early April. The adult population decreased rapidly from that time, but nymphs began to hatch in large

numbers from the eggs laid by the adults, and further adults emerged, though in small numbers only, in early June. The progeny of the latter were scarce and disappeared before the end of June without completing their development. The effects of natural enemies, climatic factors and vegetation on this sequence are discussed.

The principal natural enemies were the predacious Reduviid, *Phonoctonus subimpictus* Stål, which attacked all stages of *Dysdercus*, and the Tachinid, *Bogosia* (*Epineura*) *helva* (Wied.), which was the only parasite found. *P. subimpictus* was reared in the laboratory at temperatures similar to those in the field, living *Dysdercus* being provided as food. Two field-collected females laid 79 and 109 eggs, respectively, in groups of 2–12. The egg stage lasted 9–10 days, and the percentage hatch was 80–85. The five nymphal instars lasted 7–8, 8, 7–8, 9 and 16–17 days, respectively. Adults consumed one *Dysdercus* every 48 hours, and the larvae three each, but more are probably destroyed in the field. The adults survived without food for over two months when *Dysdercus* was no longer available.

About 25 per cent. of the *Dysdercus* population was parasitised by *B. helva* between 26th May and 12th June. In the laboratory, the females oviposited on fourth- and fifth-instar nymphs and adults of *D. superstitiosus* and *D. melanoderes* Karsch, both sexes being attacked. Usually only one egg was laid per host, but two and three were observed on 11 and 8 per cent. of them, respectively. Parasitised adults were at first not visibly affected, females continuing to deposit fertile eggs, but they survived for not longer than 14 days and died when the full-fed parasite larvae left them through the tegument to pupate. Parasitised nymphs died during their next moult, and this partly accounted for the sudden reduction in population observed in early June. The parasite larvae appeared to have difficulty in emerging from their hosts, and only 9 out of 27 succeeded in doing so. The adults obtained from them were caged with *Dysdercus*, but failed to pair or oviposit. Observations on field-collected material suggested that the larval and pupal stages lasted 10–20 and 10–14 days, respectively. The percentage of pupae that gave rise to adults was high at a relative humidity of 90 per cent., but lower at 80 per cent. The adults survived for 1–7 days.

The relative importance of these natural enemies is discussed. Though females of *Phonoctonus* lay more eggs than those of *Dysdercus*, the life-cycle is longer, and *B. helva* appeared to be the more important, although several eggs may be laid on a single host, many full-fed larvae die within their hosts and parasitised individuals are killed only slowly.

The average temperatures during the periods when adults of *Dysdercus* were migrating to the clearing, when the next generation was developing and when the population died out, were 24·1, 25·2 and 23·5°C. [75·38, 77·36 and 74·3°F.], respectively, and the corresponding relative humidities were 95, 93 and 97 per cent. There was considerable rainfall from late May. The maximum population thus coincided with the highest temperature, the lowest relative humidity and a period of little rain. The high relative humidity in June, which favoured the development of *B. helva*, and the mechanical action of the rain on all stages of *Dysdercus*, contributed largely to the disappearance of the population.

D. superstitiosus was apparently attracted to the plot by the presence of the single *Ceiba* tree in fruit, as no such development occurred in a similar clearing from which *Ceiba* was absent. The original clearing of the undergrowth created a microclimate favourable for development, with a high temperature and low relative humidity, but as herbaceous plants reinvaded the plot, reaching a height of almost five feet by the end of June and resulting in a lowering of the temperature and increase in relative humidity, conditions became unfavourable.

Biliotti (E.). **Biologie de *Phryxe caudata* Rondani (Dipt. Larvaevoridae) parasite de la chenille processionnaire du pin (*Thaumetopoea pityocampa* Schiff.).**—*Rev. Path. vég.* **35** fasc. 1 pp. 50–65, 11 figs., 13 refs. Paris, 1956.

Field and laboratory observations were carried out in France in 1951–54 on the bionomics of *Zenillia* (*Phryxe*) *caudata* (Rond.), of which *Z.* (*P.*) *secunda* (Br. & Berg.) [*cf. R.A.E.*, A **42** 407] is a synonym. This Tachinid parasitises the pine processionary, *Thaumetopoea pityocampa* (Schiff.), and it was taken in all parts of France in which its host was collected. The observations showed that it has two generations a year, the adults emerging in February–April and September–October. The spring females oviposit on fifth-instar larvae of *T. pityocampa* before they enter the soil to pupate, and the parasite larvae complete their feeding in the host pupae and themselves pupate in the soil. The autumn females oviposit on third-instar larvae of *T. pityocampa*, and the parasites complete their feeding in the fourth-instar hosts and pupate in the host nests. Adults of *Z. caudata* were kept in the laboratory in glass jars containing folded paper, at 15°C. [59°F.] and a relative humidity maintained at 70–80 per cent. by moistening the muslin covers. Sugar was provided as food. Under these conditions, the females survived for up to 65 days, with an average of about 50. The development of their reproductive organs is described. When no hosts were available, the females oviposited on the walls of the cages or on other individuals of their own species. For oviposition studies, females were transferred singly to special cages, which are described. The cage had a muslin top, and the female oviposited through the latter on a larva placed on it. The eggs were usually deposited on the intersegmental membranes, at the base of the prolegs or on the ventral wall of the abdomen, and the larvae hatched within a few moments and entered the host. Their development within the latter is described. When several eggs were laid on one host, only one or two gave rise to adults, the remaining parasites dying in the early instars; sometimes the host died before any were able to complete their development. When the host larvae were killed by virus disease [*cf.* **43** 95], the parasites survived and gave rise to adults that were fertile, though undersized.

Z. caudata was reared in the field only from *T. pityocampa*, but females in the laboratory oviposited on larvae of various Lepidoptera, including *Malacosoma neustria* (L.), *Euproctis chrysorrhoea* (L.) and *Pieris brassicae* (L.). The larvae were usually able to enter these hosts, except sometimes in the case of *Euproctis*, but soon died in the latter and did not survive beyond the second instar in *Malacosoma*, parasitised larvae of which also died. Although *Z. caudata* might therefore oviposit on other hosts in the field, it would be unlikely to complete its development in them. Other potentially suitable hosts, such as *T. processionea* (L.), are not present in a susceptible stage at the time when the adults of *Z. caudata* emerge.

Z. caudata parasitised not more than 30 per cent. of the populations of *T. pityocampa* investigated, and its relatively low effectiveness is thought to be due to the shortness of the period available in spring for oviposition and the destruction by other insects of the pupae formed in the nests of *T. pityocampa*. *Dibrachys cavus* (Wlk.) (*boucheanus* (Ratz.)) and *Habrocytus eucerus* (Ratz.) were both reared from such pupae collected in the field.

Antongiovanni (E.). **Prove sull'efficacia pratica di un nuovo estere fosforico avente azione aficida ed acaricida.** [Tests on the practical Effectiveness of a new phosphoric Ester with aphicidal and acaricidal Properties.]—*Redia* **40** (1955) pp. 57–65. Florence [1956]. (With a Summary in English.)

Laboratory tests in 1952–53 showed that L 343 [O,O-diethyl S-(N-mono-isopropyl)acetamido dithiophosphate] was very effective against Aphids and mites. When applied to leaves, it was rapidly absorbed, so that Aphids on both surfaces of the leaves were killed even if only one surface had been treated. Field tests were therefore carried out in 1954 against *Hyalopterus amygdali* (Blanch.) (*pruni*, auct.) on peach near Florence and *Metatetranychus ulmi* (Koch) (*Paratetranychus pilosus* (C. & F.)) on apple near Bologna.

Against *H. amygdali*, sprays of L 343 and parathion, both at 0·016 per cent., were applied to heavily infested peach trees on 21st July, the jet of the spray apparatus being directed perpendicularly above the crown of the trees, so that most of the leaves were sprayed on the upper surface only. L 343 caused mortality within six hours of application, and few leaves were still infested five days after treatment. Parathion was less effective and caused no mortality on a considerable proportion of the leaves. In a second test, L 343 was applied on 2nd August at 0·018 and 0·027 per cent. to the upper surface of the leaves, as before, and by the normal spraying practice, in which the whole tree is covered; parathion was applied at 0·02 per cent. by the latter method. Mortality was high within eight hours on all the trees, and no Aphids were found after five days on any of the trees treated with L 343, though eight of the ten treated with parathion were infested.

Against *M. ulmi*, L 343 was applied at 0·007 and 0·014 per cent. on 12th May to apple trees infested by all stages of the mite. Nine days after treatment, there were considerably more unhatched eggs on treated than on untreated trees, and when leaves bearing eggs were kept under favourable conditions in the laboratory, 97·7 and 97·6 per cent. of the eggs on the treated leaves failed to hatch within ten days, as compared with 6·7 on untreated leaves. The trees were re-examined on 16th July and the numbers of adults per 100 leaves were then 333 and 39 for L 343 at the two concentrations, respectively, as compared with 1,494 for no treatment. In a second test, carried out on 30th July, L 343 was applied at 0·018 and 0·027 per cent. and parathion at 0·02 per cent. to heavily infested trees. Very few adults or nymphs were found on the treated trees nine hours after spraying, and none was found after five days on those treated with L 343, though a few, including some newly hatched individuals, were present on those treated with parathion. At the final examination, 26 days after treatment, there were 9, 9 and 4,443 adults per 400 leaves on trees treated with the three sprays, respectively.

Melis (A.). **Esperienze di lotta contro la mosca delle olive (*Dacus oleae* Gmel.) in Italia nel 1954.** [Experiments on the Control of *D. oleae* in Italy in 1954.]—*Redia* **40** (1955) pp. 67–139, 3 maps (1 fldg.), 5 fldg. tables, 14 refs. Florence [1956]. (With a Summary in English.)

Large-scale tests on the control of *Dacus oleae* (Gmel.) on olive in Italy [*cf. R.A.E.*, A **44** 195] were continued in 1954, when bait-sprays were applied in Tuscany, Apulia and Sicily, sprays of organic insecticides were tested in Tuscany and bait-traps were used alone in Sicily and Tuscany and in combination with other treatments in Tuscany and Apulia. The results of some of the tests with organic insecticides have already been noticed [*cf.* **44** 200, 200–201]. In Tuscany, bait-sprays consisting of Berlese mixture [*cf.* **41** 393], De Cillis mixture [*cf.* **43** 136] or Petrosini mixture [*cf.* **43** 137] were applied on 5th–9th and 15th–18th July, 16th–19th August, 1st–4th and 20th–23rd September and 3rd–5th and 16th–22nd October. In Apulia, Berlese mixture or De Cillis mixture was applied between 28th June and 4th July, and on 9th–12th and 19th–22nd July, 10th–14th August, 1st–4th and 20th–23rd September and 1st–5th, 14th–15th and 21st–22nd

October. In Sicily, Berlese mixture was applied on 16th–20th July, 10th–13th August, 1st–4th and 20th–23rd September and 1st–5th and 19th–20th October. The bait-traps were of the Spanish type [*cf.* **35** 151], filled with 2·5–3 per cent. diammonium phosphate; the majority were set out, at the rate of one per 3–4 trees, in June and refilled at the beginning of each month until November.

In Tuscany, though the olives developed some ten days later than usual and early varieties were not available for oviposition until early July, adults were taken in the bait-traps from mid-June, and in considerably greater numbers than in 1953 [*cf.* **44** 196]. By 26th August, over 20 per cent. of the olives were infested on unprotected trees. In Apulia, very few adults were taken in the bait-traps in July, and very few olives were attacked in August. In Sicily, bait-traps were not set out until 18th–24th July, when 92·3–98·3 per cent. of the olives in one area, near Patti, were attacked. In another area, near Carini, where bait-sprays were to be applied, only 1 per cent. of the olives had been attacked by 12th July, though the infestation rose to 50 per cent. in late August.

Counts of infested olives were made in early October. In Tuscany, the percentages were 2·7–4·3 and 12·8–13·6 in the peripheral and internal zones respectively, of an area treated with bait-sprays, as compared with 29·4–51·1 in the controls, 5–6·5 and 0·7–4·8 on the periphery and in the centre, respectively, of an area protected by bait-traps, as compared with 25·7–42·6 in the controls, and 1·6–10·5 and 3·6–15·4 on the periphery and in the centre, respectively, of areas where both bait-sprays and bait-traps were used, as compared with 25·7–97·2. Good results were also obtained by individual growers with bait-sprays, alone or in combination with bait-traps, the percentages of fruits infested by early October being reduced in some localities from 62–90 to 2·5–24. Further counts were made in early November, when the infestation percentages in the peripheral and internal zones were 2·9–28 and 18·4–28·6 for bait-sprays alone, 4·3–11·9 and 0·5–4·7 for bait-traps alone and 3·3–8·8 and 1·2–10·4 for bait-sprays and bait-traps, as compared with 41·1–74·4 in the controls.

In Apulia, the infestation percentages were 1·5–2 in early October for the combined use of bait-sprays and bait-traps, as compared with 2·5–3 in the controls, and there was little change by early November. At Carini, in Sicily, where bait-sprays were used, 30–60 per cent. of the olives were attacked by early October, as compared with over 70 per cent. in the controls, while at Patti, infestation had reached 100 per cent. on all trees, whether bait-traps had been used or not. Counts at Carini on 22nd October, when picking was almost complete, showed that treated olives in non-irrigated groves were virtually free from attack, while those in irrigated groves were slightly attacked, but still commercially sound. Almost all the olives had fallen from the untreated trees between mid-September and mid-October. Promising results were given in preliminary tests in Tuscany by bait-sprays applied to the trunks and main branches, instead of to the crowns of the trees. The mixture chiefly used consisted of 5 lb. beet molasses or sugar and 1 lb. micronised lead arsenate in 9·4 gals. water, but the arsenate was sometimes replaced by malathion and diammonium phosphate was sometimes added.

In tests of low-volume sprays, Diazinon and malathion were applied at 0·2 and 3 per cent., respectively, in atomised emulsion sprays, on 8th–9th and 27th–28th September and in mid-October, about one tenth of the amount of spray normally required being applied per tree. On 5th–7th November, 88 and 98 per cent. of the olives on the trees treated with Diazinon and malathion, respectively, were uninfested, as compared with 18·25 per cent. on untreated trees. On the same dates, 90 per cent. of the

olives were uninfested on trees sprayed on 29th–30th September and in mid-October with a solution of 15 per cent. malathion in mixed solvents applied at very low volume by means of an apparatus affording a treatment referred to as " fumigation ". An emulsion spray containing 2·5 per cent. malathion was also applied on the same dates with the same apparatus fitted with a normal low-volume spray-jet, and resulted in 80 per cent. uninfested olives on 5th–7th November.

In a further preliminary test, 0·1 per cent. parathion in an emulsion spray was applied at normal volume on 15th September, when the olives contained about 10 per cent. oil, to determine whether the olives would retain sufficient parathion to protect them from attack until picking and so avoid the risk of toxic residues from treatments applied later. On 6th November, only 6 per cent. of olives were infested.

Frediani (D.). **Note sulla genesi della galla, con cenni di morfologia e biologia, della** *Dryomyia lichtensteini* **Fr. Lw. (Diptera Cecidomyidae).** [Notes on the Formation of the Gall of *D. lichtensteini*, the Morphology and the Bionomics.]—*Redia* **40** (1955) pp. 141–180, 1 pl., 23 figs., 20 refs. Florence [1956]. (With a Summary in English.)

Dryomyia lichtensteini (F. Lw.) was found in 1950 attacking *Quercus ilex* in Pisa, and a detailed account is given of the morphology of all stages of this Cecidomyiid and of observations on its bionomics [*cf. R.A.E.*, A **9** 474], with particular reference to the formation of the galls on the lower surfaces of the leaves. There was one generation a year. The larvae hatched in 4–5 days, overwintered in the galls and pupated in early April, the pupal stage lasting 15–20 days. The eggs were parasitised by the Scelionid, *Platygaster dryomyiae* Silv., and the full-fed larvae and pupae by the Pteromalid, *Amblymerus lichtensteini* (Mayr). A spray of 0·1 per cent. DDT proved effective against the adults, but cultural methods of control are preferred; they include pruning during the winter and the planting of varieties that come into leaf late.

Melis (A.). **L'entità degli sfarfallamenti invernali e primaverili in alcuni allevamenti di** *Dacus oleae* **Gmel. eseguiti nella Toscana litoranea nel 1953–54.** [The Numbers of Adults emerging in Winter and Spring during Rearing of *D. oleae* on the Coast of Tuscany in 1953–54.]—*Redia* **40** (1955) pp. 181–196, 3 graphs (1 fldg.), 4 fldg. tables, 4 refs. Florence [1956]. (With a Summary in English.)

Further investigations were carried out in 1953–54 on the winter and spring emergence of adults of *Dacus oleae* (Gmel.) in the field and in the laboratory in Tuscany [*cf. R.A.E.*, A **44** 194, etc.]. In November–December, the weather was generally mild, and there was a fair amount of rain, but January was exceptionally cold, the minimum temperatures usually being at or below freezing point and falling to −9°C. [15·8°F.] on one occasion. February was also colder than usual, but March and April were relatively mild, with regular rainfall.

As in previous years, conditions in the laboratory, where full-fed larvae were allowed to pupate in sand in metal cages or glass containers, were similar to those in the field, and the sand was moistened whenever rain fell. All the larvae entered it. No adults were obtained from larvae caged on 21st November, but 3·33 and 4·66 per cent. of those caged on 27th and 29th December gave rise to adults, the latter emerging between 25th March and 22nd April. Larvae and pupae were placed in the glass containers on 21st

November, and all the former entered the sand. Adults emerged between 26th December and 14th January, the percentage emergence ranging from 56 to 80. No adults were obtained when larvae were placed in the containers between 11th and 19th January, probably because the larvae had been affected by the preceding low temperatures; some of them did not enter the sand. It is thought that differences in the retention of heat and humidity may have caused the wide divergence in positive results between the cages and the glass containers.

In the field, 5,400 larvae were placed in sunken cages in five areas, in the second half of November, and 5,343 entered the soil. Adults were obtained from all three cages in one area, from two of the three in a second, and from one of the three in a third, the percentage emergence ranging from 0·2 to nearly 9 and giving an over-all average of 1·53 for all 15 cages. Emergence occurred between 17th February and 16th March.

These results are compared with those obtained in the two previous seasons [*cf. loc. cit.*], and as temperatures in January–February were exceptionally low in both 1953 and 1954, the paucity of emergences in the former year is attributed largely to the effects of drought in February–April.

In mid-September 1954, a pupa and a moribund female were found in a container in the laboratory in which olives that had been covered with gauze on the trees until March and were picked in mid-April, had been placed. It is thus possible for a spring generation to develop in Tuscany on olives left on the trees in winter and spring [*cf.* **44** 437].

Ciampolini (M.), Antonelli (C.) & Giardini (A.). **Osservazioni biologiche sul *Temnorrhinus mendicus* Gyll. nella valle Padana e ricerche di laboratorio e di campagna sui mezzi chimici e sui sistemi di lotta più idonei per la difesa della barbabietola da zucchero.** [Observations on the Bionomics of *Cleonus mendicus* in the Po Valley, and Field and Laboratory Investigations on the most suitable Chemicals and Control Methods for the Protection of Sugar-beet.]—*Redia* **40** (1955) pp. 213–257, 8 figs. (2 fldg.), 1 fldg. table, 7 refs. Florence [1956]. (With a Summary in English.)

Investigations on the bionomics and control of *Cleonus* (*Temnorhinus*) *mendicus* (Gylh.) on beet in northern Italy [*cf. R.A.E.*, A **43** 138] were continued near Ferrara in 1954. In that year, adults appeared from late March until early August in two fields of wheat in which beet had been heavily infested in the previous year, and trapping experiments showed that populations of about 16,800 and 28,000 adults per acre were present, respectively, although four sprays of BHC at the recommended rate had been applied in 1953. When adults were collected and reared in pairs under conditions closely resembling those in the field, examples that appeared in April, May and June fed for 30–40, 20–30 and 10 days, respectively, before pairing, and those that appeared in July for a few hours or days. Pairing was first observed in early May, and was most intense in August and September, particularly when temperatures were high. Oviposition usually began 1–2 days later. The first eggs were found in the second ten days of May, but the greatest numbers were not laid until August–September. Of the pairs of adults that appeared in April, only 20 per cent. survived until the end of October, the females laying 67–203 eggs each, with an average of 130; the average for all females was 70. Owing to the lateness of oviposition, little damage was caused by the larvae in the field.

In the first of the laboratory tests on control, emulsion concentrates were diluted with ethyl ether, which volatilises rapidly, and applied by means of a microsyringe to the elytra, control insects being treated with ether alone.

BHC was used at 0·08 per cent. (w/v), chlordane and toxaphene at 0·25 per cent., dieldrin at 0·0875 per cent., and heptachlor at 0·125 per cent., these being the recommended concentrations. Each weevil received 0·004, 0·002, 0·001 or 0·0005 cc. liquid, the highest amount corresponding to the maximum quantity of spray likely to fall directly on an adult during field treatment at the normal rate of application (36 gals. per acre). The weevils were treated in late April and kept in the open during the day. The mortality percentages in ten days for the five products, respectively, and (in brackets) for treatment with ether alone were 69, 75, 76, 81 and 82 (12) at 0·004 cc. and 21, 65, 37, 63 and 81 (4) at 0·002 cc.; at 0·001 cc., heptachlor gave 67 per cent. mortality, but the other products at this rate and all products at 0·0005 cc. gave less than 50 per cent. kill. It appears from these results that the recommended rate of application could be reduced by one third for dieldrin and chlordane and one half for heptachlor, without significant loss of effectiveness.

The contact toxicity of the insecticides was further investigated by means of boxes containing treated soil into which weevils were introduced immediately or 1–80 days after treatment, beet leaves being provided as food. The soil was treated on 9th April, 12th or 24th May or 9th June, these being the dates of field treatments, and the respective average temperatures during the first 13 days after treatment were 15, 18, 26 and 26°C. [59, 64·4, 78·8 and 78·8°F.]. In the first series, the soil was treated with wettable BHC, chlordane, toxaphene, dieldrin and heptachlor at rates equivalent to 0·288, 0·9, 0·9, 0·312 and 0·45 lb. toxicant, respectively, in 36 gals. spray per acre. The average mortality percentages shown after ten days at the three temperatures, respectively, corrected for mortality in the controls, by weevils introduced 0–3 days after treatment were 14·4, 16 and 36·1 for BHC, 13·7, 37·2 and 65·8 for chlordane, 12·3, 25·9 and 22·6 for toxaphene, 55·6, 58·7 and 77 for dieldrin and 26·5, 50·2 and 75·9 for heptachlor. At 15°C., dieldrin was significantly better than the other products; at 18°C., dieldrin and heptachlor were significantly better than the others, and at 26°C., dieldrin, heptachlor and chlordane were significantly better than BHC and toxaphene. The numbers of days for which the treated soils retained their initial toxicity and (in brackets) any toxicity at all were 1 (2) for BHC, 1 (1) for toxaphene, 2 (5) for chlordane, 4 (7) for heptachlor and 5 (10) for dieldrin.

Since four applications are normally made in the field, a further test was made by the same technique in which BHC and dieldrin were applied to the soil once (on 9th April), twice (9th April and 12th May), three times (on the same dates and 24th May) and four times (on the three previous dates and 9th June). The average mortality percentages for BHC and dieldrin, calculated as before, were 14·4 and 55·6, respectively, for one treatment, 25·6 and 73·6 for two, 42·3 and 90 for three and 46·3 and 90·1 for four. Dieldrin was significantly better than BHC, and there was no significant difference between three and four applications of either material. There appeared to be no accumulation of toxicity in the treated soil. In tests of dusts, the soil in the boxes was treated with BHC, chlordane, aldrin and heptachlor at rates equivalent to 1·35, 2·7, 1·8 and 1·8 lb. per acre, respectively, worked lightly in to a depth of about 1½ ins. The soil was treated about the time applications are made in the field, at sowing and a little before the leaves completely cover the soil, the average temperature being 15 and 26°C., respectively. The average mortality percentages of the weevils in four days at the two temperatures, respectively, were 19·9 and 76·1 for BHC, 15·1 and 64·8 for chlordane, 39·3 and 92 for heptachlor and 20·7 and 87·6 for aldrin. Heptachlor retained its toxicity the best, still giving over 50 per cent. kill 15 days after application.

In the third series of tests, also carried out in the boxes of soil, two applications of the wettable-dieldrin spray, on 9th April and 12th May, were compared with one application of the dieldrin spray on 9th April and one of the aldrin dust on 12th May and with the aldrin dust on the first date and the dieldrin spray on the second. The mortality percentages were 73·6, 65·5 and 54·6, respectively, with no significant differences between them. Two applications of the dieldrin spray still gave 50 per cent. kill after 80 days, when the other treatments had lost their effectiveness.

Field tests were carried out in small plots in an uninfested area, each surrounded by an aluminium barrier to prevent the migration of adults; beet was sown on 9th March, and weevils were introduced into the plots between 5th April and 9th June, to give a population equivalent to about 28,000 per acre. The effectiveness of the treatments was estimated at harvest, in late August. In tests with wettable-powder sprays, dieldrin, heptachlor, chlordane, toxaphene and BHC were applied at 0·315, 0·45, 0·9, 0·9 and 0·288 lb. in 36 gals. per acre, respectively, on 6th April and 19th May, on 6th April and 8th and 19th May, or on 6th and 24th April and 8th and 19th May. The percentages of uninjured roots after 2, 3 and 4 treatments, respectively, averaged 86, 94 and 96 for dieldrin, 49, 76 and 97 for heptachlor, 11, 48 and 63 for chlordane, 66, 72 and 87 for toxaphene and 59, 78 and 92 for BHC. Dieldrin was significantly better than the other products, and two applications appeared sufficient for adequate control.

In tests with dusts, chlordane at 2·7 lb. per acre, BHC at 1·35 lb. and heptachlor, dieldrin and aldrin at 1·8 lb. were applied at sowing (9th March) or at germination (22nd March) and hoed into the soil. The percentages of uninjured roots for treatment on the two dates, respectively, were 6 and 9 for chlordane, 84 and 77 for BHC, 87 and 89 for heptachlor, 84 and 97 for dieldrin and 8 and 9 for aldrin. Some of the plots dusted on 22nd March were given spray treatments on 8th May or on 8th and 19th May. The results showed that sprays were unnecessary following dusting with dieldrin, heptachlor or BHC, but that dusts of chlordane or aldrin should be followed by at least two sprays of dieldrin, heptachlor or chlordane. Some of the plots that were sprayed with BHC or dieldrin 2–4 times, and some sprayed once only (on 6th April) were dusted, 15 days later, with aldrin or heptachlor. One spray application of BHC before dusting was insufficient for adequate control. One of dieldrin was satisfactory when followed by heptachlor dust, but not when followed by aldrin. When more than one spray treatment preceded the dusting, over 90 per cent. uninjured roots were obtained in all cases, except when two applications of BHC in a spray were followed by dusting with aldrin.

Pegazzano (F.). *Quadraspidiotus marani* **Zahradnik f.** *olivicola* **f.n.** (**Hem. Hom. Coccidae, Diaspini**) **nuovo ospite dell'olivo.** [*Q. schneideri olivicola*, n., a new Pest of Olive.]—*Redia* **40** (1955) pp. 311–324, 1 pl., 6 figs., 22 refs. Florence [1956]. (With a Summary in English.)

Coccids observed on olive near Florence in June 1954 were found to represent an undescribed form of *Quadraspidiotus schneideri* Bachmann, which the author considers a synonym of *Q. mařani* Zahradník [but *cf. R.A.E.*, A **42** 350]. The scales of both sexes, the adult female and the crawler are described, and characters are given differentiating the new form, for which the name *olivicola* is proposed, from the typical *Q. schneideri*. There is one generation a year. Oviposition was observed in June and the first half of July, adults were present in early autumn, and the fertilised females overwintered. Most individuals were found on the lower surfaces of

the leaves, with only a very small proportion on the twigs, and none on the upper surface of the leaves or on the fruits.

Ciampolini (M.). **Note sulla morfologia e sulla biologia dell'** *Amathes lychnidis* **F. (Lepidoptera Noctuidae).** [Notes on the Morphology and Bionomics of *A. lychnidis*.]—*Redia* **40** (1955) pp. 325–344, 1 pl., 15 figs., 7 refs. Florence [1956]. (With a Summary in English.)

Amathes lychnidis (F.) was observed damaging carnations in the Province of Pistoia in 1952–53. Its food-plants are reviewed from the literature, and the larva, pupa and adults of both sexes are described. The adults appeared in late March or early April and paired 2–3 days later. The eggs were laid singly or in small groups in cracks in the soil round the food-plants, the females laying 150–200 each in about a week. The larvae hatched in 10–15 days, fed on the young leaves and bored into the central shoots. When the flower buds were formed, the larvae fed on these, at first externally and then internally, destroying the reproductive organs. After feeding for about a month, they pupated in the soil. The pupal stage lasted 85–90 days, and adults emerged in numbers on 10th–15th August. Second-generation eggs were laid soon afterwards, and the egg and larval stages of this generation lasted 10–12 and 25–30 days, respectively, the pupae overwintering. The larvae caused considerable damage to the buds, greatly reducing flower-production. Insecticides are recommended for control, in addition to the collection and destruction of infested buds.

Ciampolini (M.). **Dati emersi dalle prove di lotta contro il** *Dacus oleae* **Gmel. con esteri fosforici nel 1955.** [Data obtained in Control Tests against *D. oleae* with Phosphoric Esters in 1955.]—*Redia* **40** (1955) pp. 353–371, 1 graph, 3 fldg. tables, 3 refs. Florence [1956]. (With a Summary in English.)

Nacamuli (S.). **La convenienza economica della lotta antidacica con diversi metodi di difesa.** [The Cost of various Methods of Control against *D. oleae*.]—*T. c.* pp. 373–397, 1 fldg. table, 9 refs. (With a Summary in English.)

An account is given in the first paper of further experiments in Tuscany on the control of *Dacus oleae* (Gmel.) on olive by means of phosphorus insecticides [*cf. R.A.E.*, A **44** 200], carried out in 1955. Infestation began in late June and increased rapidly, so that almost all the olives on untreated trees were infested by mid-September. The crop was picked in early November.

In one of the two groves concerned, parathion in an emulsion spray was applied 1–3 times at 0·1 and 0·05 per cent., once at 0·08 per cent., once at 0·1 per cent. followed by a second application at 0·05 per cent., and once at 0·1 per cent., followed by second and third applications at 0·05 and 0·03 per cent., respectively. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] in emulsion sprays was applied once, at 0·04 per cent., twice, at 0·04 and 0·03 per cent., or three times, at 0·04, 0·03 and 0·02 per cent., respectively. A malathion emulsion concentrate was applied 1–3 times to give 0·2 per cent. malathion, and mixed emulsion concentrates of malathion and parathion were similarly applied to give 0·075 per cent. malathion and 0·03 per cent. parathion. The trees treated once were sprayed on 22nd August or 1st or 16th September, those treated twice were sprayed on 22nd August and 20th September or on 1st and 25th September, and those

treated three times were sprayed on 22nd August, 20th September and 8th October.

On 21st August, before treatment was begun, 48·5 per cent. of the olives were damaged, 8·3, 9·5 and 23·5 of them being infested with eggs, larvae and pupae, respectively, and 7·2 per cent. showing exit holes. The mortality percentages of the eggs in olives sprayed on 22nd, picked on 23rd and examined on 29th August, corrected for mortality in the controls, averaged 81, 71 and 55 for parathion at 0·1, 0·08 and 0·05 per cent., respectively, 66 for 0·04 per cent. Diazinon, 11 for malathion and 49 for the malathion-parathion mixture. The percentages of living larvae in olives examined 10, 20 and 30 days after treatment on 1st September were 0, 11 and 38, respectively, for parathion at 0·1 per cent., 1, 13 and 49 for parathion at 0·08 per cent. and 29, 33 and 95 for parathion at 0·05 per cent., 37, 25 and 50 for Diazinon at 0·04 per cent., 97, 97 and 99 for malathion, and 20, 47 and 76 for the malathion-parathion mixture, as compared with 98, 99 and 99 for no treatment.

The olives that fell after the beginning of treatment were collected, examined and pressed, in addition to those picked from the trees. All the fallen fruits from both treated and untreated trees showed signs of attack by *Dacus*, as did 80–100 per cent. of those still on the treated trees at picking. There were, however, significant differences between the percentage of attack on trees treated three times with parathion or Diazinon and those treated once or twice only with these products.

The percentages of the olives remaining at picking on trees treated with parathion were 19, 45 and 78 for one treatment at 0·1 per cent. applied on the three dates, respectively, 80 and 76 for two treatments at 0·1 per cent. applied at the two periods, respectively, and 80 for three treatments at 0·1 per cent. For parathion at 0·05 per cent., they were 7, 23 and 60 for one treatment, 55 and 58 for two treatments and 62 for three treatments, and they were 17, 41 and 80 for one treatment with parathion at 0·08 per cent. on the three dates, respectively, 75 and 78 for two treatments (at 0·1 and 0·05 per cent.) at the two periods, respectively, and 80 for three applications (at 0·1, 0·05 and 0·03 per cent., respectively). The corresponding percentages for Diazinon and (in brackets) malathion were 15, 50 and 58 (7, 2 and 10) for one treatment, 60 and 62 (3 and 14) for two treatments, and 71 (15) for three treatments, and for the malathion-parathion mixture they were 2, 30 and 48 for one treatment, 55 and 54 for two treatments and 58 for three. All the fruits had fallen from untreated trees by the end of October. Olives from the treated trees yielded 18–22 per cent. oil, as compared with 13–15 per cent. from untreated trees. The acidity of the oil was considerably higher for olives treated once with any of the products on 22nd August or 1st September than for those treated once on 16th September or 2–3 times, but was in most cases lower than that of oil from untreated olives, which was 6·5 per cent.

In the other grove, the trees received either eight applications of sweetened bait-sprays containing 0·03 per cent. sodium arsenite, between 25th June and 20th October, or five applications of the latter between 25th June and 15th September, followed on 27th September by a single application of an emulsion spray containing 0·1 or 0·05 per cent. parathion, 0·04 per cent. Diazinon, 0·2 per cent. malathion, a mixture of 0·03 per cent. parathion and 0·075 per cent. malathion, or 0·15 per cent. of a compound referred to as trichloromethylphosphoric ester. By 27th September, all the olives on untreated trees had been attacked, about 85 per cent. of them having exit holes, while 80 per cent. were attacked on treated trees, 60 and 10 per cent. containing larvae and pupae, respectively, and 10 per cent. showing exit holes. The percentages of olives attacked and (in brackets) the percentages

with exit holes at picking on 1st November were 100 (100) for bait-sprays alone or for no treatment, and 80 (40), 82 (48), 81 (43), 98 (98), 80 (50) and 82 (40) for the bait-sprays followed by the six emulsion sprays, respectively. The percentages of olives that fell before picking were 77 for no treatment, 42 for bait-sprays alone, 25 for malathion and 10–15 for the remaining treatments. The yield of oil was 17–18 per cent. for all treatments, and its acidity reached only 1·5–2·7 per cent., as compared with 10–15 per cent. for untreated olives.

It is concluded that sprays of parathion or Diazinon afford good protection and prevent premature falling of the olives, but that the time of application is of considerable importance. Phosphorus insecticides should not be applied before September, since earlier applications may destroy natural enemies and the toxicant will not be retained in the fruits, since their oil content is still low. If it is desired to protect the olives earlier in the year, bait-sprays should be used.

In the second paper, the author reviews the damage caused to olives by *D. oleae* in Italy and other countries and discusses the returns given by the treatments applied in the first of the two groves referred to in the first paper. The percentages of olives that remained on the trees until picking, and had thus reached complete maturity, were highest on trees treated with parathion once at 0·08 per cent. on 16th September, twice (on 22nd August and 20th September) or three times at 0·1 per cent., or three times at 0·1, 0·05 and 0·03 per cent., respectively. Of these treatments, the least costly was the one spray at 0·08 per cent., and this is therefore recommended. The cost of treatment could be reduced still further by the use of low-volume sprays.

Melis (R.). **Necessità di una accurata ricerca sui residui nei prodotti agrari difesi con insetticidi di sintesi e sull'azione che essi esercitano sugli animali a sangue caldo.** [The Necessity for accurate Research on the Residues in agricultural Products treated with synthetic Insecticides, and on the Effect of these on warm-blooded Animals.]—*Redia* **40** (1955) pp. 399–423, 2 fldg. tables, 29 refs. Florence [1956]. (With a Summary in English.)

The author stresses the importance of investigations on the toxicity of the residues that remain in edible plant products after field treatment with insecticides, and reviews at some length, from the literature, work on the toxicity to warm-blooded animals of the phosphorus compounds, notably parathion, that have been tested for the control of *Dacus oleae* (Gmel.) on olive in Italy. Large-scale investigations on the problem were begun there in 1955, and details are given of treatments with numerous insecticides currently recommended against *D. oleae*, including phosphorus compounds, that were applied in order to obtain oil samples for analysis and testing against laboratory animals.

Thorsteinson (A. J.). **The experimental Study of the chemotactic Basis of Host Specificity in phytophagous Insects.**—*Canad. Ent.* **87** no. 2 pp. 49–57, 24 refs. Ottawa, 1955.

The author reviews techniques devised for the investigation of the chemical stimuli that render particular plants attractive to phytophagous insects and discusses the results of his own work with *Plutella maculipennis* (Curt.) in England [*cf. R.A.E.*, A **42** 194], and *Leptinotarsa decemlineata* (Say) and *Sitona cylindricollis* Fhs. in Canada. The techniques considered

are for the measurement of feeding responses to plant extracts [*cf.* **24** 513; **42** 194, 204], the extraction and purification of feeding stimulants [*cf.* **42** 204] and the collection and storage of plant material from which the stimulants are to be isolated. Some evidence was obtained that the response of *L. decemlineata* to an attractant of no nutrient value was enhanced by the addition of certain nutrient substances, such as sugar, but this was not the case with *S. cylindricollis*, though the latter responded to relatively pure extracts from the leaves and flowers of sweet clover [*Melilotus*], provided that it could feed on the edges of the treated artificial leaves in its characteristic manner. It showed no response to coumarin, a well-known perfume constituent of sweet clover, when it was added to a test diet, but J. D. Truscott observed that lucerne was more severely infested by the weevil when close to *Melilotus* than when at a distance, possibly because coumarin exerts an olfactory stimulus over a short distance. Such studies are of value in investigations of the control of noxious weeds by insects and the development of crop plants resistant to insect attack.

Stultz (H. T.). **The Influence of Spray Programs on the Fauna of Apple Orchards in Nova Scotia. VIII. Natural Enemies of the Eye-spotted Bud Moth,** *Spilonota ocellana* **(D. & S.) (Lepidoptera: Olethreutidae).** —*Canad. Ent.* **87** no. 2 pp. 79–85, 15 refs. Ottawa, 1955.

In this part of a series dealing with long-term investigations of the effects of sprays on the arthropod fauna of apple orchards in Nova Scotia [*cf. R.A.E.*, A **43** 357, etc.], the author records the results of observations on the natural enemies of *Spilonota ocellana* (Schiff.). Lists are given of 25 primary parasites of the moth that were taken in orchards each year from 1946 to 1953, together with one earlier recorded from the Province that was not observed, with notes on their frequency, and of the insect and other predators observed attacking the moth in small cages or free in the orchard, showing the stages attacked. *Agathis laticincta* (Cress.) was the most important of the parasites [*cf.* **43** 356], and the maximum observed percentage parasitism by it was 93. *Trichogramma minutum* Ril. became of importance after 1948, occurred in most of the orchards and parasitised an average of 12–23 per cent. of the eggs. *Meteorus trachynotus* Vier., *Ascogaster quadridentata* Wesm., *Euderus subopacus* (Gah.), *Ephialtes* (*Scambus*) *hispae* (Harris) and an unidentified parasite of the same genus occurred in many orchards, but the first three rarely afforded more than 20 per cent. parasitism each, and the last two rarely more than 10 per cent. *Atrometus clavipes* (Davis), which parasitises the pupae, was present in most orchards, but parasitism by it seldom exceeded 1 per cent. Over 20 arthropod predators were found, of which all but two were usually present at their appropriate seasons unless highly toxic sprays had been used; they varied greatly in numbers. *Haplothrips faurei* Hood was the most important egg predator and generally caused high mortality, but the relative importance of the species that attacked the larvae could not be determined.

Predators and all the more important parasites except *Agathis* were very considerably reduced by DDT and parathion [*cf.* **43** 357]. The regular application of arsenicals caused little or no reduction of predators, except *Anystis agilis* Banks, but considerably reduced the more important parasites, except *T. minutum*. Nicotine sulphate reduced several predators, but its use in spring against *Anuraphis roseus* Baker and in mid-July against *S. ocellana* did not reduce *T. minutum* or *Agathis*. Of the fungicides, sulphur seriously checked the predators, *H. faurei*, *Leptothrips mali* (Fitch), *Anystis agilis* and *Anthocoris musculus* (Say), and *H. faurei* was also seriously reduced by dichlone [2,3-dichloro-1,4-naphthoquinone]. All the principal

parasites were relatively abundant after the use of copper fungicides or glyodin [2-heptadecyl glyoxalidine acetate] [*cf.* **43** 357]. *M. trachynotus* and *Ascogaster* were rare after the application of ferbam [ferric dimethyl dithiocarbamate] or flotation sulphur for several successive years. Parasitism by *Agathis* in orchards that had been sprayed for four seasons with copper compounds, ferbam or flotation sulphur amounted to 36, 26 and 47 per cent., respectively, in 1949, after which sulphur was replaced by glyodin; after a further three years, the parasitism percentages were 43, 60 and 65, respectively.

The only disease agent definitely associated with mortality of *Spilonota* was a polyhedral virus found in late-instar larvae in June and early July. Larvae affected by it at first showed extreme liquefaction, but later collapsed and dried out. The incidence of the disease varied with year and locality, but mortality was rarely more than 10 per cent.

Church (N. S.). **Moisture and Diapause in the Wheat Stem Sawfly, *Cephus cinctus* Nort. (Hymenoptera: Cephidae).**—*Canad. Ent.* **87** no. 2 pp. 85–97, 24 refs. Ottawa, 1955.

Full-fed larvae of *Cephus cinctus* Nort. on wheat in Canada enter an obligatory diapause in autumn in the wheat stubs, and the sawfly is unique in that larvae in which the diapause has been eliminated in spring sometimes enter a further diapause [*cf. R.A.E.*, A **37** 126]. The experiments described were carried out to assess the importance of moisture in these processes. Diapausing larvae collected in September 1953 were kept in moist soil at 10°C. [50°F.], at which diapause development is most rapid, for 0, 30, 60 or 90 days, after which their moisture content was determined and the number in which diapause was terminated was found by incubating them in moist soil at 25°C. [77°F.]. The water content of prepupae that had developed from larvae chilled for 120 days at 10°C. and had been incubated for 7–11 days was also determined. It was found that water was taken up during diapause development and still more just before and during prepupal morphogenesis; there was also a loss of dry matter that approached in quantity the water absorbed. Diapausing larvae stored for 150 days in moist soil at 25°C. absorbed little water. Chilling at 10°C. for up to 120 days in dry soil did not affect the number of larvae in which diapause was eliminated and development was resumed on incubation in moist soil, but in two samples incubated in dry soil, only 26 and 36 per cent. resumed development. Experiments with larvae obtained in 1952 gave very similar results, and it is concluded that moisture is not needed for diapause development, though it is required by many individuals for the initiation of post-diapause morphogenesis, which can be accomplished at either 10 or 25°C.; some of the moisture is absorbed in the transition period.

The effect of dryness on the re-establishment of diapause was investigated in post-diapause larvae that had been collected in the autumn, stored in moist soil at 25°C. and then transferred first to 10°C. and later, when the first few had emerged from dormancy, to 0°C. [32°F.], at which most of the transitional development can be completed but post-diapause morphogenesis cannot begin. The larvae were not removed from their stubs, since there is a critical period between the end of diapause and shortly before the formation of the prepupa, when further development is frequently inhibited by removal. Larvae incubated from the beginning of the transition stage at 25°C. in a current of dry air developed normally, although the transition period of those collected in 1952 lasted two weeks. When kept at 35–50°C. [95–122°F.] for periods of up to several days in moist or dry conditions and subsequently incubated in moist soil at 25°C., nearly all the larvae died

within 12 hours at 50°C. and within two days at 45°C. [113°F.], and most of those that survived died during incubation. Larvae survived for at least a week at 40°C. [104°F.] and for very much longer at 35°C., and after a week at the latter temperature all usually re-entered diapause; larvae that survived exposure to 40°C. more frequently developed than those exposed at 35°C., and some of those that failed to do so were probably permanently injured by the heat. Lack of moisture during the heat treatment did not affect the results, which were confirmed by another test in which the proportion of larvae that re-entered diapause after being covered with dry or moist soil for 2–8 days at 35°C. was unaffected by the moisture content; all re-entered diapause after exposure for eight days and virtually all after exposure for six. The effect of desiccation at subdevelopmental temperatures was investigated in larvae that were collected in autumn and, after elimination of the obligatory diapause, exposed to a current of dry air at 0°C. for 0, 30 or 60 days. The percentages of moisture lost in 30 and 60 days were 9 and 24, respectively, and the percentages of larvae that failed to develop in moist soil after these periods of exposure were 6 and 32; only 11 per cent. of control larvae failed to develop after exposure to 0°C. for 120 days in moist soil. In another test, larvae collected in April, exposed for 5–50 days to 0°C. in dry air and subsequently incubated at 25°C. all developed when incubated in moist soil and virtually all when incubated in dry, though the beginning of development was delayed in some. In a similar test in which autumn-collected larvae were stored at 0°C. under moist conditions before being subjected to dry air, most were able to develop except those kept under dry conditions for 50 days and incubated in dry soil, 21 per cent. of which failed to do so. Among others kept for the last part of the storage period of 20 months in dry soil, the percentages that did not develop after dehydration for 5, 20 or 50 days were 79, 86 and 100 following incubation under dry conditions and 35, 50 and 81 under moist. Non-developing larvae in diapause usually become active on chilling, and larvae in which a second diapause was initiated by exposure to 35°C. for one or two weeks under moist conditions resumed development at 25°C. only after exposure to 10°C. for 2–4 months or 5°C. [41°F.] for longer. Heat thus causes a true diapause. Larvae that had been subjected to dryness did not subsequently resume development, even after chilling at 10°C. for 5–6 months, and it is concluded that dehydration does not induce true diapause but probably causes a pathological condition from which the larva does not recover.

In tests of the effect of reduced body moisture on the re-establishment of diapause by heat, 14–18 per cent. of post-diapause larvae that were kept in dry air for 60 days at 0°C. failed to develop on incubation in moist soil at 15°C.; of others kept at 35°C. and 95 per cent. relative humidity for 2–6 days before incubation, fewer re-entered diapause when the exposure to 0°C. had been in dry soil than when in moist.

In a discussion of the bearing of these results on the forecasting and control of infestation, it is stated that moisture conditions in winter and early spring affect populations directly through the mortality caused by desiccation and indirectly by their influence on soil temperatures. Shallow spring cultivation to bring the stubs to the surface has been recommended for control [*cf.* **29** 112], but if this is carried out before the overwintered larvae begin metamorphosis, they may be warmed enough and sufficiently early to re-enter diapause and survive for another year [*cf.* **37** 127]; very early drying of the stubs without warmth is harmful to the larvae. As diapause can be reinstated in a week or less at 95°F., at least some of the population is likely to be affected in western Canada if the temperature of the soil just below the surface exceeds 92 or 93°F. for a few days during the latter part of April and the first half of May.

Coppel (H. C.) & Leius (K.). **History of the Larch Sawfly, with Notes on Origin and Biology.**—*Canad. Ent.* **87** no. 3 pp. 103–111, 1 pl., 1 map, 2 pp. refs. Ottawa, 1955.

Lejeune (R. R.). **Population Ecology of the Larch Sawfly.**—*T. c.* pp. 111–117, 6 refs.

Muldrew (J. A.). **Parasites and Insect Predators of the Larch Sawfly.**—*T. c.* pp. 117–120, 9 refs.

Buckner (C. H.). **Small Mammals as Predators of Sawflies.**—*T. c.* pp. 121–123, 10 refs.

Bird (F. T.). **Virus Diseases of Sawflies.**—*T. c.* pp. 124–127, 12 refs.

MacLeod (D. M.) & Heimpel (A. M.). **Fungal and Bacterial Pathogens of the Larch Sawfly.**—*T. c.* pp. 128–131, 14 refs.

Smith (S. G.). **Cytogenetics of obligatory Parthenogenesis.**—*T. c.* pp. 131–135, 1 fig., 11 refs.

Discussion.—*T. c.* pp. 136–139.

Balch (R. E.). **Concluding Remarks.**—*T. c.* pp. 140–141.

These papers are contributions to a symposium held in Canada in 1954 on approaches to the study of forest insects, with special reference to the larch sawfly, *Pristiphora erichsonii* (Htg.). The first contains reviews of the taxonomy and bionomics of this Tenthredinid and of the history of infestation of larch by it in Europe, Asia, Canada and the United States. In the second, an account is given of work in progress in Canada on the interaction of the principal mortality factors that affect it [*cf. R.A.E.*, A **39** 435], and on the development of life tables [*cf.* **44** 159] for it, which was begun in 1954 at Winnipeg. The insect parasites and predators that attack the sawfly in central Canada, their status and the relative value of natural control agents [*cf.* **39** 435; **43** 133] are discussed in the third, and the fourth contains an account of recent work in south-eastern Manitoba on the importance of small mammals in destroying the cocoons [*cf.* **37** 442]. Information on the use of virus diseases in the biological control of other sawflies in Canada and on the factors that influence their spread [*cf.* **33** 398; **41** 23; **43** 263], the course of epizootics in *Gilpinia* (*Diprion*) *hercyniae* (Htg.) on spruce in New Brunswick in recent years, and the factors that affect the pathogenicity of insect viruses is given in the fifth paper, and the sixth deals with the fungi and bacteria that attack *P. erichsonii* in Canada [*cf.* **43** 354]. In the seventh, the mechanism for maintaining the diploid number of chromosomes in *P. erichsonii* despite its obligatory parthenogenesis is discussed. The discussion and concluding remarks deal briefly with various aspects of the earlier subjects.

Hobbs (G. A.) & Lilly (C. E.). **Ecology of Species of *Megachile* Latreille in the Mixed Prairie Region of southern Alberta with special Reference to Pollination of Alfalfa.**—*Ecology* **35** no. 4 pp. 453–462, 6 figs., 23 refs. Brooklyn, N.Y., 1954.

The following is based on the authors' summary. The importance of each of the 14 species of leaf-cutting bees of the genus *Megachile* that occur in the lucerne seed-growing region of southern Alberta was determined by reference to distribution in the Province, frequency and abundance in mixed prairie, nesting habits, pollen preferences and flight period. Species that are confined to mixed prairie, are ground-nesting in habit, prefer lucerne pollen and emerge at the time of the coming of lucerne into bloom are the most beneficial. Under present conditions the ground-nesting species *M. dentitarsus* Sladen and *M. perihirta* Ckll. are the most important. *M. dentitarsus*,

although its flight period is later than that of *M. perihirta*, is considered the more useful, because *M. perihirta* is less closely associated with lucerne. When the season is abnormally short, as in 1951, *M. perihirta* is more important. In general, the wider the distribution of a species, the less important it is as a pollinator of lucerne in mixed prairie. The most important of the criteria is flight period, because man has no control over it. It is difficult to increase the abundance of species that have reached the outer limits of their distribution, but theoretically possible to increase the frequency and abundance of other species by providing nesting sites, materials for nest construction, and food sources. Efficiency would be increased by planting lucerne fields and leaf-cutting sources close to nesting sites. In determining the value of *Megachile* spp. as pollinators of lucerne, only flower records (pollen preferences) for females should be considered. These should include all plants in flower in the area where the bee is gathering pollen.

Breakey (E. P.). **Control of Spittlebugs on Strawberries.**—*Ohio J. Sci.* **55** no. 1 pp. 63–64, 2 refs. Columbus, Ohio, 1955.

Large numbers of young nymphs of *Philaenus leucophthalmus* (L.) were found in early May 1953 infesting strawberry plants in western Washington, causing severe deformation of the leaves. The field had been planted in 1952, and it appeared that the eggs had been laid on the parent plants late in the summer of that year and the nymphs had not yet dispersed to the runner plants. On 12th–13th May, when the flower buds had not yet opened, dusts of 2·5 per cent. heptachlor or aldrin or 5 per cent. chlordane or DDT were applied at about 20 lb. per acre. Counts on 17th–18th June showed that the average numbers of froth masses per 100 ft. of row were 14·1, 18·7, 29·1 and 90·1 for the four dusts, respectively, as compared with 203·7 for no treatment.

Burkhardt (C. C.) & Bryson (H. R.). **Notes on Distribution of the Western Corn Rootworm, *Diabrotica virgifera* Lec., in Kansas (Coleoptera; Chrysomelidae).**—*J. Kans. ent. Soc.* **28** no. 1 pp. 1–3, 1 map, 3 refs. Manhattan, Kans., 1955.

A survey of maize fields carried out in July–August 1953 in 61 counties in northern and western Kansas showed that *Diabrotica virgifera* Lec. was present in 50 counties. Adults were taken as far east as Nemaha, Pottawatomie, Wabaunsee, Morris and Chase counties [*cf. R.A.E.*, A **42** 289–290]. Infestation was heaviest in the north, up to 100 beetles per plant being observed in Jewell and Republic counties. Adults were collected on numerous occasions by sweeping with a net in fields of lucerne that were in blossom, some of the fields being a quarter of a mile from any maize.

Beer (R. E.). **Biological Studies in the Genus *Periclista* (Hymenoptera, Tenthredinidae, Blennocampinae).**—*J. Kans. ent. Soc.* **28** no. 1 pp. 19–26, 2 figs., 1 ref. Manhattan, Kans., 1955.

Periclista linea Stannard, all stages of which are described, is injurious to live oak (*Quercus agrifolia*) in the San Francisco Bay region of California. This sawfly has one generation a year. Males and females were present from early spring, and the latter oviposited beneath the scales of leaf buds that would open in about a week. The larvae remained within the buds and were usually in the third instar when the leaves expanded. They fed on the leaves, dropped to the ground at the end of the fifth instar, entered the soil to a depth of about 1–2 ins., constructed cocoons in which they aestivated

and hibernated in the sixth instar, and pupated in the following spring. At 72°F., the egg stage and first five larval instars lasted 5, 1–2, 1, 1, 1 and 3 days, respectively. The damage to buds and leaves was often sufficient to warrant control measures, and spraying with 4 oz. parathion in 100 U.S. gals. water gave high mortality of the larvae before or immediately after hatching.

Kunkel (L. O.). **Maintenance of Yellows-type Viruses in Plant and Insect Reservoirs.**—[*In*] Hartman (F. W.), Horsfall jr. (F. L.) & Kidd (J. G.). Ed. The Dynamics of Virus and Rickettsial Infections (International Symposium) pp. 150–163, 1 graph, 27 refs. New York, N.Y., Blakiston Co., Inc., 1954.

The following is based on the author's summary of this paper, in which evidence is given of the effectiveness of *Macrosteles fascifrons* (Stål) in transmitting the virus of aster yellows. When virus-free groups of 50, 72, 50 and 56 nymphs that had been allowed to feed on infected china aster (*Callistephus chinensis*) for two hours, one day, one week and two weeks were caged singly and transferred daily to successive healthy aster or rye plants, 6, 47, 42 and 53 insects transmitted the virus, the percentages of plants infected being about 71, 72, 75 and 78, respectively, and 41, 21, 8 and 0 did not transmit it; the remaining insects lived for not more than 25 days after the beginning of the test and were ignored. About 54·7, 83·1 and 91·8 per cent. of the infective insects continued to transmit the virus to within 2, 4 and 6 days, respectively, of their death. These results indicate that although most if not all examples of the Cicadellid are susceptible to infection by the virus, some are much more so than others, and it is possible, though not proved, that infective examples remain so for the rest of their lives.

Dunning (R. A.). **A diurnal Rhythm in the Emergence of** *Pegomyia betae* **Curtis from the Puparium.**—*Bull. ent. Res.* **47** pt. 4 pp. 645–653, 3 graphs, 3 refs. London, 1956.

The following is virtually the author's summary of this account of observations on the adult emergence of the beet fly, *Pegomyia hyoscyami* var. *betae* (Curt.), carried out in the laboratory and outdoor cages in eastern England. There was a clear diurnal rhythm in the emergence of the adults from the soil, peak emergence occurring daily between 6 and 7 a.m., when the soil temperature at a depth of 2 ins. and the air temperature are at about their minimum, or are just beginning to rise, and humidity is at its maximum. In two observations on the emergence of the first generation, 82·2 and 85·6 per cent. of the daily emergence occurred before 8 a.m., while in two observations on the emergence of the adults of the non-diapausing part of the second generation, 79·1 and 76·3 per cent. of the daily emergence occurred before 8 a.m. [*cf. R.A.E.*, A **22** 212]. During the period of emergence of flies from a batch of puparia, the rhythm was most marked at the time of peak emergence, and was less marked at the beginning and end of the emergence period. The rhythm of emergence was much less pronounced, and the peak occurred later in the day, when puparia were kept at constant temperature from two days before the first flies emerged.

Experiments led to the conclusion that the fly reaches the soil surface within one hour of leaving the puparium at a depth of 2 ins. in soil, and that the processes of wing expansion and cuticle tanning are probably controlled by a nervous mechanism. The possible initiators of the diurnal rhythm are discussed. It is concluded that the results obtained could be explained by

the suggestion that the rhythm is induced by the effect of temperature or light fluctuation at some time before the late pupal stage, or that it might be inborn in the species, and that it is further regulated by temperature variation at the time of emergence. Further work is necessary before the suggested explanation can be shown to be valid or otherwise.

Smith (K. G.). **The Occurrence and Distribution of** *Aphomia gularis* **(Zell.) (Lep., Galleriidae), a Pest of Stored Products.**—*Bull. ent. Res.* **47** pt. 4 pp. 655–667, 1 pl., 1 map, 76 refs. London, 1956.

The author reviews the literature on the bionomics and distribution of *Aphomia gularis* (Zell.), which infests stored almonds, walnuts, groundnuts, prunes and, to a less extent, rice and grain, concluding that it originated in south-eastern Asia, spread from there to the major ports of western Europe, Canada and the United States, and is likely to spread still further unless control measures are undertaken, and discusses its occurrence in Britain [*cf. R.A.E.*, A **19** 404; **21** 580], where a generation was found to require 12–15 weeks at 24°C. [75·2°F.] and 56 per cent. relative humidity.

Adults were recently observed to be active in unheated warehouses in London in June, July and, exceptionally, May; adults of a further generation were occasionally found in August–September. Active larvae occurred from June to November, though most had spun cocoons by October–November; pupation takes place in April. At the time of writing, infestations were firmly established in three and, probably, four warehouses and a wholesale premises in London, all of which were concerned principally with the storage of edible nuts. A survey in north-western England showed the presence of endemic populations in almond mills at two places, in the premises of nut-processing and confectionery firms and general warehouses at one of the places and five others, and a provender mill at yet another. Most of these infestations resulted from direct trading with the London warehouses, but a few arose after nuts or kernels had passed through infested cleaning mills, or from infested refuse from such mills. All but three of the infested premises were partly or wholly heated, and infestation was eradicated from two of the unheated ones. Isolated examples were found at two places in Scotland.

Simmonds (F. J.). **An Investigation of the Possibilities of Biological Control of** *Melittomma insulare* **Fairm. (Coleoptera, Lymexylonidae), a serious Pest of Coconut in the Seychelles.**—*Bull. ent. Res.* **47** pt. 4 pp. 685–702, 1 pl., 5 figs., 44 refs. London, 1956.

Since it seemed unlikely that *Melittomma insulare* Fairm., the most serious pest of coconut in the Seychelles, could be controlled by cultural measures or the use of insecticides [*cf. R.A.E.*, A **29** 341; **42** 120], investigations were begun on the possibility of biological control. The few available data on the bionomics and distribution of other Lymexylids were assembled from the literature and the labels of museum specimens, and are summarised in an annotated list for over 40 species. The only record found of an insect attacking a Lymexylid was one of the Nitidulid, *Rhizophagus dispar* (Payk.), which is stated to feed on the eggs of *Hylecoetus dermestoides* (L.) in Scotland. No natural enemies were found in Trinidad during a study of the bionomics of *Atractocerus brasiliensis* Lep. & Serv. [**23** 711], which was observed infesting mango logs. Since *R. dispar* might attack the eggs of *M. insulare*, investigations on it were to be begun.

Coombs (C. W.). **Stability of Grain as a Factor influencing the Oviposition Rate of the Grain Weevil,** *Calandra granaria* **(L.) (Col., Curculionidae).** —*Bull. ent. Res.* **47** pt. 4 pp. 737–740, 2 refs. London, 1956.

It has been suggested that oviposition by *Calandra granaria* (L.) in wheat is greatest when the grains are held in a stable position [*cf. R.A.E.*, A **37** 323], and since grains held in cracks in an empty granary might thus present favourable oviposition sites and facilitate a carry-over of infestation to the new stock, experiments were carried out in the laboratory to verify the assumption. Groups of weevils, each comprising a male and two females, were confined with 30 grains of wheat that were inserted into cracks in wood or plaster, gummed to glass at random or in rows, or scattered loose on glass or plaster. The eggs laid were counted and the grain renewed every eight days. Significantly more eggs were laid in fixed grains than in loose, but no other significant differences were found, and it is therefore concluded that the observed increase in oviposition when the grains are in cracks is due to their immobility and not to the fact that they are partially enclosed or in rows. The females laid significantly fewer eggs as they aged, irrespective of treatment. The distribution of the eggs laid in grain in cracks did not differ significantly from random. Grains in cracks more frequently contained three or more eggs each than did loose ones, but as only one adult usually develops in a grain, this increased oviposition has little effect on population size. To be effective, an increase in oviposition must result in an increase in the number of grains infested, and this (for random egg distribution) varies with the mean number of eggs per grain. The effectiveness of increased oviposition due to the fixed position of the grains varies inversely with population density.

Doncaster (J. P.). **The Rice Root Aphid.**—*Bull. ent. Res.* **47** pt. 4 pp. 741–747, 33 refs. London, 1956.

The author reviews the literature on the identity of an Aphid that attacks the roots of rice and other graminaceous plants in various parts of the world and shows that it is *Rhopalosiphum rufiabdominalis* (Sasaki). Characters distinguishing it from other species of the genus are described, and a list of its synonyms is given. These include *R.* (*Siphocoryne*) *splendens* (Theo.) [*R.A.E.*, A **3** 749; **27** 542; **28** 489], *Aresha shelkovnikovi* Mordv. [**10** 58], *Yamataphis oryzae* Mats., *Y. papaveris* Tak. [**10** 408], *R. subterraneum* Mason [**25** 736; **28** 180, 650; **34** 318; **38** 376] and *Cerosipha californica* Essig [**34** 318], and it is the species referred to by George in South India as *R. avenae* (F.) [**14** 139]. As the types of *Yamataphis* and *Aresha* are both synonyms of it, these two genera sink to *Rhopalosiphum*; *Y. rhodesiensis* Hall, described from Southern Rhodesia in a paper already noticed [**20** 248] cannot be included in *Rhopalosiphum*, and the genus *Hallaphis*, n., is erected for it.

The primary food-plants of *R. rufiabdominalis* are *Prunus* spp., including *P. cerasifera* and, possibly, peach, *P. mume* and *P. serotina*, and its secondary food-plants are poppy (*Papaver somniferum*), *Gossypium* sp., *Hibiscus esculentus*, beans (*Phaseolus vulgaris*), *Oenothera laciniata*, celery, tomato, potato, *Solanum* sp., *Orobanche* sp., *Gnaphalium* sp., *Parthenium argentatum*, *Iris* sp. and *Psilopilum crispulum*, in addition to many graminaceous plants, including barley, wheat, sugar-cane and rice. It is recorded from Argentina, Dutch Guiana, Egypt, Fiji, Formosa, Hawaii, South India, Israel, Japan, Kenya, Morocco, New Zealand, Peru, Spain, Tanganyika, Tristan da Cunha, and the United States.

Bhambhani (H. J.). **Responses of Pests to Fumigation. VI. Water Losses and the Mortality of** *Calandra* **spp. at reduced Pressures.**—*Bull. ent. Res.* **47** pt. 4 pp. 749–753, 8 refs. London, 1956.

In this part of a series [*cf. R.A.E.*, A **42** 332, etc.], an account is given of experiments on water loss and mortality in *Calandra granaria* (L.) and *C. oryzae* (L.) at low pressures and controlled humidities [*cf.* **42** 40]. Pressures of 2, 4 and 8 cm. mercury were adopted, and weevils were exposed to relative humidities of about 0, 45 and 85 per cent. for four, eight or ten hours at each of them. The following is almost entirely the author's summary of the results. The mortality of both species was closely associated with loss of water, which was prevented by high humidity in the surrounding air. *C. oryzae* was consistently more susceptible than *C. granaria*. Substantially linear relations were observed between water loss and decreasing relative humidity, increasing period of exposure, and decreasing pressure. In a subsidiary experiment in which the weevils were exposed for up to 48 hours to pressures of 3 or 4 mm. mercury, the water loss and mortality of both species were greatly reduced, suggesting that some physical change had occurred in the insects. A covariance analysis of the mortality response, using the loss of water as a concomitant variate, showed that there was no significant part of the mortality that was not accounted for by the water loss from the insects.

Box (H. E.). **New Species and Records of** *Diatraea* **Guilding and** *Zeadiatraea* **Box from Mexico, Central and South America (Lepid., Pyral.).**—*Bull. ent. Res.* **47** pt. 4 pp. 755–776, 1 pl., 4 figs., 34 refs. London, 1956.

Records are given of the occurrence and food-plants, with, in some cases, discussions of the systematics, distribution and economic status, of some 20 species of *Diatraea* and four of *Zeadiatraea* of which the larvae bore in graminaceous plants, based largely on surveys in Mexico and Central and South America. The records for Venezuela are additional to those in a paper already noticed [*R.A.E.*, A **40** 3], but most of those for Peru and Mexico have already been published [*cf.* **39** 430, 431; **43** 220]. The three new species of *Diatraea* described include *D. veracruzana* from Mexico, where the larvae are common in sugar-cane over considerable areas of Veracruz and also attack *Paspalum* spp. Other species recorded from sugar-cane include *D. saccharalis* (F.) in Guatemala, Salvador, Panama (rarely), Colombia and Brazil; *D. impersonatella* (Wlk.) in Brazil; *D. indigenella* Dyar & Heinr. in Colombia; *D. tabernella* Dyar, which is the dominant sugar-cane borer in Costa Rica and Panama (including the Canal Zone), but is of economic importance only in the latter; *D. guatemalella* Schaus in Costa Rica; and *D. flavipennella* Box in Brazil. *D. saccharalis* is also recorded from rice in Brazil and maize in Guatemala, *D. evanescens* Dyar from sorghum in Brazil, and *Z. lineolata* (Wlk.) [*cf.* **44** 447] from maize in Salvador and Nicaragua.

Dutt (N.). **Mandibular Length in** *Nupserha bicolor* **Thoms. ssp.** *postbrunnea* **Breun. (Col., Lamiidae) as the Factor in determining the Site of Oviposition in** *Corchorus olitorius*.—*Bull. ent. Res.* **47** pt. 4 pp. 777–783, 1 pl., 5 figs., 6 refs. London, 1956.

The following is largely the author's summary. Ovipositing females of *Nupserha bicolor postbrunnea* Breun. cause loss of stem length in jute (*Corchorus olitorius*) in West Bengal by girdling the stem above and below a slit in which the egg is laid [*cf. R.A.E.*, A **44** 428]. The slit is made by two successive indentations of the mandibles and is composed of a central

pit and two lateral punctures. Girdling followed by oviposition is restricted to that portion of the stem that falls within the stem-diameter range of 0·2–0·4 cm., and girdling without oviposition to the portion within the range 0·41–0·5 cm. A relation was found between the length of the mandibles of the female, which averaged 0·654 mm., the depth of the stem tissue from the epidermis to the periphery of the pith (extra-medullary tissue), and girdling and oviposition. For girdling, the optimum ratio between mandibular length and the depth of the extra-medullary tissue as measured from the epidermal furrow and from the ridge of the stem (which is pentagonal in this region) was 1:0·8 and 1:0·99, respectively.

Duerden (J. C.), Hayward (L. A. W.) & Somade (B.). **The Persistence and Toxicity of Insecticides under tropical Conditions. I. The Persistence of γ BHC and its Toxicity to** *Tribolium castaneum* **(Hbst.).**—*Bull. ent. Res.* **47** pt. 4 pp. 797–801, 5 graphs, 2 refs. London, 1956.

As a result of preliminary tests [*cf. R.A.E.*, A **40** 265], routine spraying with wettable γ BHC at monthly intervals was adopted for the control of *Tribolium castaneum* (Hbst.) on stored decorticated groundnuts at Kano, Northern Nigeria. Subsequent observations indicated that large numbers of *T. castaneum* were present within a fortnight of spraying, and investigations were therefore carried out. The following is largely the authors' summary of the work.

The persistence and toxicity to *T. castaneum* of initial deposits of about 10, 20 and 40 mg. γ BHC per sq. ft. were studied over a period of three weeks. Solutions were applied by means of an atomiser to filter papers that were then pinned with the sprayed side uppermost to plaster boards and exposed in a typical warehouse at Kano at about 75–80°F. Sample papers were removed every two days up to the tenth day and on the 15th and 20th days, and their toxicity was determined by confining groups of ten adults on each and counting the numbers dead every 24 hours for the next four days; the amount of residue was determined by chemical analysis. Both methods of assessment indicated that the lowest rate of application was inadequate for practical control and that the other two showed very similar biological activity for up to eight days after treatment. Thereafter, small quantities persisted from applications at the highest rate for a further week, but the resultant mortalities were inadequate for field control. It is concluded that, to maintain control of *T. castaneum*, weekly applications would be required and that the rate of application should approximate to 20 mg. per sq. ft.

Sheals (J. G.). **Soil Population Studies. I. The Effects of Cultivation and Treatment with Insecticides.**—*Bull. ent. Res.* **47** pt. 4 pp. 803–822, 6 graphs, 24 refs. London, 1956.

The following is almost entirely the author's summary. The effects of cultivation and treatments with DDT and BHC on soil Collembola and Acarina were investigated near Glasgow in 1951–52. Cultivation resulted initially in a drastic reduction of the micro-arthropod population, and this reduction persisted in plots that were left fallow. Re-seeding with perennial ryegrass (*Lolium perenne*) resulted in rapid recolonisation by Collembola, but the populations of Oribatei and Mesostigmata remained at a low level over a period of 17 months after sowing. Treatment in May with a 2 per cent. crude BHC dust at 2 oz. per sq. yard prior to reseeding caused a heavy reduction of most micro-arthropods. Treatment with 2 per cent. crude DDT dust at the same rate caused reductions of mites, particularly Mesostigmata, but there was a marked increase of Collembola in the plots so treated. Significant increases of Collembola and significant reductions of predacious

Mesostigmata were also noted in plots treated with a 1:1 mixture of the two dusts at 4 oz. per sq. yard when compared with those receiving BHC alone. The increase of Collembola was thus associated with a reduction of predatory pressure. In most cases, the effects of the treatments that included BHC were apparent 17 months later, but a temporary recovery of near-surface dwelling Collembola occurred in the BHC-treated plots in February 1952, nine months after treatment. Of the groups and species significantly affected in October 1951 by the insecticide treatments, only in the case of *Punctoribates punctum* (Koch) in plots treated with DDT did the data of October 1952 produce significant evidence of recolonisation.

Logothetis (C.). **The Senn Pest, *Eurygaster integriceps*, in the Near East.** —*FAO Plant Prot. Bull.* **5** no. 2 pp. 21–25, 2 figs. Rome, 1956.

Eurygaster integriceps Put. is one of the most injurious insect pests of cereals in Turkey, Syria, Persia, Iraq and the Soviet Union, and causes limited damage in Afghanistan and the Lebanon. Wheat is the crop most severely attacked, and the injury caused is of two types. The adults feed on the stems of young plants in spring, killing some 25 per cent. of those in non-irrigated fields, where no tillers are produced, and the nymphs and adults later feed on the kernels at the stage of milky ripeness, greatly reducing the yield and affecting the baking quality of the flour by the introduction of certain enzymes into the grains. The bionomics of the Pentatomid are briefly reviewed [*cf. R.A.E.*, A **41** 28; **42** 277; etc.]. Organic phosphorus insecticides have given good results in control experiments [*cf.* **42** 327; **44** 44], and DDT has proved effective under certain conditions. The bug has several natural enemies, and *Microphanurus semistriatus* (Nees), which parasitises the eggs, has been reared in the laboratory and liberated in Persia [*cf.* **41** 29]. About 200 million individuals were released in that country during the past year, at the rate of about 4,000–5,000 per acre. It appears, however, that releases of about 12,000 per acre are necessary for the attainment of 90–95 per cent. control of the pest. A survey of the conditions prevailing and the research work in progress in a number of the countries affected was carried out by an FAO working party in May–July 1956, with a view to making recommendations to the governments concerned regarding the co-ordination of control measures.

Outbreaks and new Records.—*FAO Plant Prot. Bull.* **5** no. 2 pp. 29–30. Rome, 1956.

S. N. Banerjee & A. N. Basu report (p. 29) that the rice root Aphid, *Rhopalosiphum rufiabdominalis* (Sasaki) [*cf. R.A.E.*, A **45** 61], has recently been observed in the plains of West Bengal feeding on the underground parts of rice and potato plants. The growth of the plants is stunted, but they are seldom killed. The Aphid is present on potato in January and February, on rice in June, and on various grasses during the winter and summer.

Agarwala (S. D.). **On the Control of Paddy Hispa (*Hispa armigera* Oliv.) at Pusa (Bihar—India).**—*Indian J. Ent.* **17** pt. 1 pp. 11–16. New Delhi, 1955.

Hispa armigera Ol. causes severe damage to rice in Bihar, sometimes destroying whole plots and infesting the new seedlings if replanting is attempted. It is estimated that over 25,000 acres a year are affected, and the average loss of yield may be as high as 50 per cent. In experiments on control, sprays were applied to rice growing in flood water on 24th and 25th September 1949, adults taken in random sweeps with a net were counted on

22nd–23rd September, 11th–12th October and 1st–2nd November, and the yields of grain (with husks) and of straw at harvest on 8th–12th December were measured separately. Populations were reduced highly significantly by spraying with 2·5 or 1·25 lb. BHC in 100 gals. water per acre, with or without the supplementary measure of cutting off the leaves 4 ins. above water before spraying, significantly by 1 lb. DDT in 100 gals., with or without leaf cutting, and insignificantly or not at all by 2·5 lb. DDT or 0·5 lb. BHC, with or without leaf cutting, or by allowing pigs to graze in the plots for an hour. All treatments caused increases in the yield of grain, though these were significant only for 2·5 lb. BHC and 1 lb. DDT with leaf cutting, 0·5 lb. BHC without leaf cutting and 1·25 lb. BHC with or without it, the last being the most effective. All treatments but 1 and 2·5 lb. DDT practically doubled the yield of straw. It is concluded that spraying with 1·25 lb. BHC in 100 gals. per acre is the most promising treatment, and it completely controlled a mild outbreak that occurred in 1950.

Janjua (N. A.). **Biology of** *Agriotes meticulosus* **Cand. (Elateridae, Coleoptera) in Baluchistan.**—*Indian J. Ent.* **17** pt. 1 pp. 17–24, 5 refs. New Delhi, 1955.

Agriotes meticulosus Cand. has caused considerable damage to potato in recent years in the hilly parts of Baluchistan, where it was first recorded in 1938, and detailed studies on its bionomics were made in 1945–49. The distribution of this wireworm is reviewed, all stages are described, and a list is given of the other plants attacked; minor damage is caused to beet, spinach, crucifers and cucurbits, and tomato is sometimes seriously injured. The larvae bore in the potato seed-pieces and roots, sometimes stunting young plants or destroying the crop entirely, and later, in the newly formed tubers. The life-cycle was found to last three years; in 1945, eggs were laid, sometimes singly, but usually in batches of 4–6, in cavities about an inch below the surface of the soil, between 28th February and 9th May, and they hatched between 5th April and 8th June. The first-year larvae lived mainly on the roots of grasses and entered hibernation at a depth of 6–8 ins. between 18th October and 12th November. The second-year larvae resumed activity between 8th March and 2nd May, caused extensive crop damage and re-entered hibernation at a depth of 8–10 ins. between 5th October and 9th November. The third-year larvae resumed feeding between 12th March and 6th May, caused extensive damage to crops and pupated at a depth of 10–12 ins. between 26th September and 16th October. The adults remained in the pupal cells for 5–6 months, until February–March 1948, before coming to the surface, after which they paired within a day. They usually sheltered in cracks or under surface débris or stones, moving over the surface or taking short flights on warm days. In observations on 29 insects, the egg stage averaged 33·7 days [*cf. R.A.E.*, A **40** 250], the feeding periods in the three seasons 189·4, 191·7 and 192·8 days, the two larval hibernation periods 159·5 and 163·9 days, the prepupal and pupal stages 7·8 and 20·5 days, and the preoviposition and oviposition periods 11·7 and 26·6 days; the adults lived for 30–68 days after pairing, and the females deposited 127–301 eggs each.

Prasad (V. G.). **A second Eulophid Parasite (***Encarsia ncomaskelliae***, n.sp.) on** *Ncomaskellia bergii* **Signoret on Sugarcane in Bihar.**—*Indian J. Ent.* **17** pt. 1 pp. 49–51, 1 fig., 5 refs. New Delhi, 1955.

Ncomaskellia bergii (Sign.) is assuming importance as a pest of sugar-cane in northern Bihar. *Eretmocerus delhiensis* Mani has been recorded parasitising the larvae [*cf. R.A.E.*, A **32** 393, etc.], and a species of *Encarsia* here

described from adults of both sexes as *E. neomaskelliae*, sp. n., was reared in large numbers from the larvae and pupae in the laboratory at Pusa, where the percentage parasitism averaged 38–46 in 1949. Eggs of this Aphelinid laid in puparia hatched in 30–60 hours, and the larval and pupal stages lasted 3–5 and more than three days, respectively. Males lived for 24–36 hours, and females for about 50–60, the complete life-cycle lasting 8–12 days under optimum conditions (65° F. and 92 per cent. relative humidity). The females laid 80–110 eggs each, and there were usually 6–7 generations in the course of the cane season.

Rattan Lal. **Effect of the Water Content of Aphids and their Host Plants on the Appearance of Alatae.**—*Indian J. Ent.* **17** pt. 1 pp. 52–62, 2 graphs, 13 refs. New Delhi, 1955.

Observations on *Rhopalosiphum pseudobrassicae* (Davis) on mustard during the winter of 1952–53 at New Delhi indicated that any combination of temperature and relative humidity that leads to a reduction in the vapour pressure of the air causes a direct decrease in the water content of the Aphids as a result of evaporation, and an indirect decrease by diminishing the water content of their food-plants, and this reduced water content is believed to be responsible for the appearance of alates among their offspring [*cf. R.A.E.*, A **27** 323]. The increase in production of alate Aphids observed as a result of crowding is probably due to inadequacy of the water supply, and that resulting from starvation to loss of moisture from the body of the parent. The total water content of alates was found to be much less than that of apterae, irrespective of external conditions. Although alates and apterae were found in December to contain 82·7 and 88·8 per cent. moisture, respectively, in the whole body, they contained 91·7 and 72·7 per cent., respectively, in the abdomen, and it is probably the comparatively greater water content of the abdomen of the alates that is responsible for their reduced tendency to produce alate offspring during the normal parthenogenetic cycle, as compared with the apterae.

These results can be used for the prediction of infestations, since dry atmospheric conditions, a reduced water content in the plants or crowding of the Aphids will be followed by an increase in the production of winged migrants.

Subba Rao (B. R.). **A new Species of *Chelonus* on *Heliothis armigera* (Fabricius** [*sic*]).—*Indian J. Ent.* **17** pt. 1 pp. 63–64, 2 figs. New Delhi, 1955.

Descriptions are given of the adults of both sexes of the Braconid, *Chelonus narayani*, sp. n., which was reared from larvae of *Heliothis armigera* (Hb.) in the laboratory in New Delhi in October 1952 and subsequently bred in large numbers on *Corcyra cephalonica* (Stnt.) and shipped to the United States for release against Lepidopterous pests. A male and female later reared from *Chilo zonellus* (Swinh.) were found to be essentially similar to the new species in all characters but the colour of the abdomen, which was slightly darker.

Mehra (B. P.) & Kapur (A. P.). **Bionomics and Control of *Tessaratoma javanica* (Thunberg), a sporadic Pest of Kusum (*Schleichera oleosa*) in Chota Nagpur.**—*Indian J. Ent.* **17** pt. 1 pp. 76–88, 14 figs., 9 refs. New Delhi, 1955.

Schleichera oleosa (*trijuga*) is a major food-plant of the lac insect [*Laccifer lacca* (Kerr)] in India and almost the only one on which the valuable

kusumi variety of lac is produced. It is attacked by several insects in Chota Nagpur, including *Tessaratoma javanica* (Thnb.), which is widely distributed and sporadically causes considerable damage. Adults and nymphs of this Pentatomid, all stages of which are described, feed on the young shoots, which dry up or become stunted, and the food supply for the crawlers of *L. lacca* is thereby reduced. The bugs are particularly destructive in July–August. Field-cage experiments in 1951–52 showed that oviposition began in March and ended in October. Females deposited 2–21 masses of up to 28 eggs each on the leaflets of *S. oleosa* or on the leaves or flowers of other plants. Most of the eggs were laid in the middle of the summer, and the oviposition period averaged about 50 days. Observations on 23 females showed that nine that emerged in October–December 1951 and two that did so in June–August 1952 did not oviposit until the succeeding year, respectively, after preoviposition periods of 111–279 days, whereas 12 that emerged in March–August 1952 oviposited the same year after 23–72 days; eight of 12 unfertilised females caged for four months did not oviposit, and the eggs laid by the others did not hatch. Males and females were collected in equal numbers in the field, but emerged in the ratio of 3:4 in cages.

The egg stage lasted 7–21 days, depending largely on season, and the five nymphal instars averaged 14·2, 6·5, 8·5, 13·8 and 19·8 days; 9 of 64 insects had a sixth instar lasting 20·4 days. The duration of development from egg to adult averaged 74 days during the summer and 189 days over the winter. The eggs were readily parasitised in the laboratory by *Anastatus colemani* Crwf., which also attacks them in the field, and the development of the parasite within the egg required 11–42 days. Collecting the bugs in hand nets from April to May or June is recommended for control. Both nymphs and adults can be dislodged from the trees by smoke and then collected or crushed.

Subramaniam (V. K.). **Control of the Fluted Scale in Peninsular India.**—*Indian J. Ent.* **16** (1954) pt. 4 pp. 391–415; **17** pt. 1 pp. 103–120, 16 figs., 6 refs. New Delhi, 1955.

As surveys in 1942–45 showed that *Icerya purchasi* Mask. was present not only in hill districts of Madras [*cf. R.A.E.*, A **33** 384] but also in parts of the plains, on the hills of Travancore and almost throughout Mysore [*cf.* **33** 391], had reached Poona (Bombay) [**34** 287] and Coorg, and was becoming a threat to *Citrus* production, a central laboratory was established in 1946 for the mass rearing and distribution of the introduced *Rodolia cardinalis* (Muls.) and other natural enemies of the Coccid. Stocks of *R. cardinalis* were obtained from the Nilgiri Hills [*cf.* **33** 385] and from New Zealand, and rearing was carried out, by a method that is described, until late 1950 or early 1951, by which time over 52,000 adults had been bred and released in infested localities. Laboratory observations showed that the females laid up to 600 eggs each, with an average of about 320, that development was completed in about 25 days, and that the adults survived for about 30 days. During their feeding period of about 13 days, the larvae destroyed 200–250 eggs of *I. purchasi* each. The indigenous *R. fumida* Muls. (*roseipennis* Muls.), *R. breviuscula* Weise, *R. netara* Kapur, *R. minima* Kapur, *R. amabilis* Kapur and an undescribed variety of the last [*cf.* **37** 218], which are also predacious on *I. purchasi*, were also reared, and details of the bionomics of the last five are given; they developed rather more slowly and laid fewer eggs than did *R. cardinalis*, but destroyed more eggs of *I. purchasi* per larva.

R. cardinalis was released each year from 1946 to 1951 in Mysore, in all but the last year in Travancore, in all but the last three in Coorg, and in 1947 in Bombay, and releases of indigenous species were also made in some years in these States and in Madras. *R. cardinalis* was recovered from the beginning of 1948 onwards, sometimes at considerable distances from the release points, and had become established in all infested areas by the end of that year. It had become more numerous than the indigenous species by 1950, and the latter tended to disappear in all areas when it was present. Very good control of *I. purchasi* was obtained by the end of 1950, and the Coccid was found to have completely disappeared from many areas in which intensive sampling was carried out. A list is given of 117 species of plants found to be infested by *I. purchasi* during surveys in connection with the work, 50 of them being new food-plant records for the Coccid in India. *Homalotylus flaminius* (Dalm.), which parasitises the larvae of several of the indigenous species of *Rodolia*, was observed attacking *R. cardinalis* by the middle of 1947.

Other natural enemies of *I. purchasi* investigated included the predacious Pyralid, *Euzophera cocciphaga* Hmps. [*cf.* **39** 29], which was found near Bangalore but could not be reared in the laboratory, and the parasite, *Cryptochetum iceryae* (Will.), which was introduced from California and liberated, but failed to become established. *C. grandicorne* Rond. was found occasionally parasitising *I. purchasi* on *Casuarina* near Bangalore, but its main hosts appeared to be other species of *Icerya*.

Seshagiri Rao (D.). **The insecticidal Potential of the Corolla of Flowers.**—*Indian J. Ent.* **17** pt. 1 pp. 121–124. New Delhi, 1955.

As the flowers are attacked by insects less than other parts of plants, those of 12 species were dried and powdered, and kerosene extracts of them were tested as sprays on adults of *Calandra* (*Sitophilus*) *oryzae* (L.), to discover whether they had any insecticidal effect. Several of the extracts gave higher mortalities in 24 hours than kerosene alone, and *Poinciana regia*, *Caesalpinia pulcherrima* and unidentified species of *Cassia*, *Bougainvillea* and *Barleria* caused complete or almost complete kill in 120 hours or less and were about as effective as pyrethrum.

Sen (A. C.). **Basic Factors for forecasting epidemic Outbreaks of the Rice Bug** (*Leptocorisa varicornis* **F.**).—*Indian J. Ent.* **17** pt. 1 pp. 127–128. New Delhi, 1955.

Leptocorisa varicornis (F.) is a widely distributed major pest of rice in India. It is most injurious during the grain-forming stage, as it sucks the juices from the developing seeds, and mainly attacks summer rice and varieties that mature before the end of October. An outbreak that occurred in Bihar in September–October 1952, when several adjacent States were simultaneously infested, was forecast in early July, on the basis of field studies of alternative food-plants of the Coreid. It is found on *Echinocloa* (*Panicum*) *crusgalli* from the end of March until June, when it spreads to the cultivated *Panicum miliare*, *Setaria italica* and *Eleusine coracana*, and it has been observed that in years in which intermittent showers in April and May are accompanied by temperatures of 85–100°F., these plants thrive, so that the bug multiplies rapidly and spreads to rice fields with the advent of the monsoon. Such population increases do not occur when there is little or no rain during the pre-monsoon months. It was also observed that the activity of *L. varicornis* came to an abrupt end if heavy rain fell in the first

week of October. Adults have been found on the wild *Clerodendron infortunatum* throughout winter and spring. The outbreak was controlled by dusting with 5 per cent. BHC at 20–25 lb. per acre, which was best applied in the afternoon on calm days.

Sen (A. C.). **Control of the Mealy-bug Pest in Bihar.**—*Indian J. Ent.* **17** pt. 1 pp. 129–132, 2 figs. New Delhi, 1955.

Wasiul Haque (M.). **Some new Host Plants of** *Drosicha stebbingi* **(Green) (Rhynchota: Coccidae) in Bihar.**—*T. c.* pp. 137–140, 2 figs., 7 refs.

In the first of these papers, it is reported that *Drosicha stebbingi* (Green) (*mangiferae* (Green)) has been increasing for the last 4–5 years in Bihar, where it is second only to species of *Idiocerus* as a pest of mango. The eggs of this mealybug are laid in large clusters in the soil beneath the trees, and the nymphs usually hatch between the third week of December and end of January and wander for several days before ascending the trees and settling on tender shoots or leaves or on the inflorescences. Investigations on control were carried out from July 1952 to March 1955. Raking the soil for two yards round the trees once a month from July to December, to destroy the eggs, reduced the nymphal population by about 50 per cent. [*cf. R.A.E.*, A **39** 29], but applications of 0·5 lb. 10 per cent. toxaphene or DDT or 5 per cent. BHC, 1 lb. potassium permanganate in 4 gals. water, 4 gals. kerosene emulsion or 1·5 oz. calomel per tree after preliminary raking in July failed to prevent hatching. As about 80 per cent. of the nymphs ascend the trees over a period of 1·5 months, the trunks were treated with adhesives applied in a 3-inch band about 1·5 feet above ground to trap them [*cf.* **32** 420], but most of the adhesives tested lost their effectiveness in 1–6 days. However, one new proprietary material was effective for 83–99 days, and it is recommended that it should be applied in the third week of December, before the usual hatching period. Large numbers of nymphs collected below the bands, where they could readily be killed. In tests of insecticides, treatment with 10 per cent. DDT or BHC dust, chlordane, toxaphene and proprietary parathion and pyrethrum preparations gave partial control of nymphs in the first and second instars in 2–6 days, but were of little use against the third instar and had no effect on the eggs.

In the second paper, the author reviews the synonymy of *D. stebbingi* [*cf.* **38** 46] and records the plants on which he observed it in northern Bihar in January–April 1952 and January 1953. They included *Citrus*, banana and pigeon pea (*Cajanus cajan*). A severe outbreak that occurred on a small plot of *C. cajan* in 1953 is described and is considered to have originated from neighbouring infested litchi (*Litchi chinensis*).

Butani (D. K.). **Control of an Outbreak of the Army Worm (*Cirphis unipuncta* Haw.) on Sugarcane, at Pusa, Bihar, 1953.**—*Indian J. Ent.* **17** pt. 1 pp. 133–136, 2 figs., 7 refs. New Delhi, 1955.

Pseudaletia (*Cirphis*) *unipuncta* (Haw.) was first observed in Bihar in sugar-cane fields at Pusa in August 1953, after the floods had receded, and caused almost complete defoliation of 63 varieties over an area of 50 acres. It was also found on neighbouring grasses. Dusting with 5 per cent. aldrin, DDT or BHC or 2·5 per cent. dieldrin at 20 lb. per acre in the late evening during September gave 67·6–70 and 86·3–94·7 per cent. reduction in population after 1·5 and 4 weeks, respectively, with no significant differences between them, though aldrin and dieldrin seemed slightly more effective than DDT and BHC. Similar trends were observed in the laboratory. On leaves treated with DDT, 15 per cent. of the larvae pupated in three days; the

pupal stage lasted 10–12 instead of the usual 7–10 days, and the adults died in 2–6 hours.

Pradhan (S.) & Prasad (S. K.). **Correlation between the Degree of Damage due to *Chilo zonellus* Swin. and the Yield of Jowar Grain.**—*Indian J. Ent.* **17** pt. 1 pp. 136–137. New Delhi, 1955.

On a plot of sorghum (jowar) infested with up to 22 larvae of *Chilo zonellus* (Swinh.) per foot-length of row at harvest, records were made of the ears produced, the total number of nodes and length of each plant, and the number of nodes and length of stalk affected by the borer for each plant, and the ears were kept for five months, after which the grain from each was threshed and weighed.

Calculations showed that for a given number of ears per plant, the yield per plant is negatively correlated with the percentage of length infested and that for a given percentage of length infested, it is positively correlated with the number of ears per plant. It is estimated that for unit increase in the percentage of length infested, the average decrease in the yield per plant will be 0·9257 gm.

Steinhaus (E. A.) & Smith (R. F.). Ed. **Annual Review of Entomology. Volume I.**—9 × 6 ins., ix + 466 pp., illus., many refs. Stanford, Cal., Annual Reviews, Inc., 1956.

This is the first of a proposed series of annual volumes, the object of which is to publish authoritative and concise reviews of subjects of current entomological interest. Each review is to present a critical analysis of recent literature, and so far as possible an appraisal of the present status of the subject. Those in this first volume comprise: **The Physiology and Biochemistry of Diapause,** by A. D. Lees (pp. 1–16, 114 refs.); **Insect Nutrition,** by H. Lipke & G. Fraenkel (pp. 17–44, 269 refs.); **The "Language" and Orientation of the Honey Bee,** by K. von Frisch & M. Lindauer (pp. 45–58, 3 figs., 46 refs); **The Stability of Scientific Names,** by R. L. Usinger (pp. 59–70, 11 refs.); **Some Aspects of Geographic Variation in Insects,** by T. H. Hubbell (pp. 71–88, 1 fig., 40 refs.); **Arthropod Resistance to Chemicals,** by W. M. Hoskins & H. T. Gordon (pp. 89–122, 1 graph, 158 refs.), in which the subjects discussed are diversity in reaction to a toxicant as a basic characteristic of a population, the differences between susceptible and resistant strains as revealed by the dosage-mortality curve, and the use of the slope of the log-probit line as a measure of heterogeneity, certain genetic aspects of heterogeneity, and the biochemical mechanisms known to be concerned in resistance to insecticides; **The Mode of Action of Insecticides,** by C. W. Kearns (pp. 123–148, 3 figs., 137 refs.), in which the insecticides discussed are DDT, BHC, pyrethrum with synergists, and the organophosphates; **The Chemistry of Insecticides,** by Hubert Martin (pp. 149–166, 66 refs.), in which the materials considered are DDT and its analogues, the hexachlorocyclopentadiene group (with which γ BHC is included), the pyrethrin group, and the organophosphates; **Persisting Insecticide Residues in Plant Materials,** by F. A. Gunther & R. C. Blinn (pp. 167–180, 82 refs.), in which the insecticides considered include systemic toxicants; **Repellents,** by V. G. Dethier (pp. 181–202, 144 refs.), which deals chiefly with the action of compounds used for protection against insects of medical importance; **Soil Insects and their Control,** by J. H. Lilly (pp. 203–222, 4 figs., 83 refs.), in which the use of soil insecticides against crop pests in the United States is discussed; **Stored Product Entomology (the Assessment and Reduction of Losses caused by Insects to stored Foodstuffs),** by E. A. Parkin (pp. 223–240.

144 refs.); **Apparatus for Application of Insecticides,** by J. L. Brann jr. (pp. 241–260, 12 figs., 63 refs.), in which ground apparatus is reviewed; **Ecology of Forest Insects,** by S. A. Graham (pp. 261–280, 122 refs.), which deals mainly with research in Canada and the United States; **Some recent Advances in Apicultural Research,** by C. G. Butler (pp. 281–298, 108 refs.); **Insect Transmission of Plant Viruses,** by F. F. Smith & P. Brierley (pp. 299–322, 187 refs.); **Nonbiting Flies and Disease,** by D. R. Lindsay & H. I. Scudder (pp. 323–346, 187 refs.); **Veterinary and Medical Acarology,** by H. S. Fuller (pp. 347–366, 87 refs.); **Modern Quarantine Problems,** by A. F. Camp (pp. 367–378, 18 refs.), which is concerned with the current situation in the United States; **The fundamental Theory of Natural and Biological Control,** by W. R. Thompson (pp. 379–402, 27 refs.), which comprises mainly a critical appraisal of the views of A. J. Nicholson; and **Effect of Pesticides on Balance of Arthropod Populations,** by W. E. Ripper (pp. 403–438, 215 refs.).

An index to the authors whose work is reviewed and one to subjects are appended.

Mendes (L. O. T.). **Sôbre a ocorrência de** *Palorus subdepressus* **Woll. no Brasil.** [On the Occurrence of *P. subdepressus* in Brazil.]—*Bragantia* **13** pp. xxi–xxii, 9 refs. Campinas, 1954. (With a Summary in English.)

The author reviews the world distribution of *Palorus subdepressus* (Woll.), and states that numerous examples of this Tenebrionid were found in 1954 in Campinas, Brazil, in a bag containing stored maize that was severely infested by *Sitrotoga cerealella* (Ol.) and *Calandra* (*Sitophilus*) *oryzae* (L.).

Mendes (L. O. T.) & de Tella (R.). **Estudos sôbre a longevidade de adultos de** *Lasioderma serricorne* **F., o besourinho do fumo.** [Studies on the Survival Period of Adults of *L. serricorne*, the Tobacco Beetle.]—*Bragantia* **14** no. 12 pp. 117–128, 8 graphs, 1 ref. Campinas, 1955. **Sôbre um tropismo manifestado por adultos de** *Lasioderma serricorne* **F., quando mantidos sexualmente isolados.** [On a Tropism exhibited by Adults of *L. serricorne* when isolated according to Sex.]—*T. c.* pp. xv–xviii, 1 graph, 1 ref. (With Summaries in English.)

In the experiments described in the first of these papers, batches of ten newly emerged adults of *Lasioderma serricorne* (F.), from three lots of larvae reared in wheat flour and separated according to sex in the pupal stage, were kept in test-tubes held vertically in the dark at 30°C. [86°F.] and 85 per cent. relative humidity. The tubes were covered with cotton cloth and contained cassava flour to provide foothold for the beetles, which do not feed. The average numbers of days for which the males and (in brackets) the females survived were 23·06 (33·63), 24·63 (26·53) and 19·66 (21·18) for adults from the three cultures, respectively. There were significant differences between the sexes in each case and also between males and females from the third culture and those from the other two. The reduced survival period for the third culture is attributed to a greater density of the larvae, and it is concluded that the resulting competition was responsible for shortening the life of the adults.

In the second paper, details are given of the percentages of the males and females from the first of the larval cultures that rested on the flour and on the cloth. By the seventh and eighth days, about 90 per cent. of the males and 95–98 per cent. of the females, respectively, were found on the cloth, and this behaviour is tentatively ascribed to a negative geotropism. When

about half the males had died (by the 23rd–24th day), 70 per cent. of the survivors were on the cloth, and when about half the females had died (on the 35th day) about 85 per cent. of the survivors were on the cloth. It appears, therefore, that the intensity of the reaction declines with senescence.

Mendes (L. O. T.). **Podridão interna dos capulhos do algodoeiro obtida por meio de insetos.** [Internal Boll-rot of Cotton, obtained by Means of Insects.]—*Bragantia* **15** pp. ix–xi, 4 refs. Campinas, 1956. (With a Summary in English.)

In tests in São Paulo, Brazil, in 1936–37, field-collected examples of *Dysdercus mendesi* Blöte, *D. honestus* Blöte, *D. ruficollis* (L.), *Nezara viridula* (L.), *Edessa meditabunda* (F.) and *Hypselonotus fulvus* (Deg.) were allowed to feed, singly or in pairs, on cotton bolls. All species induced internal rotting, positive results being obtained in 43 of 107 tests. Examination of cultures of the affected tissues from 34 bolls showed that bacteria were responsible in 20 of them and the fungus, *Nematospora gossypii*, in four. Bacteria were obtained from cultures of the rostrum of 18 examples of *Dysdercus* spp.

Guagliumi (P.). **Contribuciones al estudio de la candelilla (*Aeneolamia* spp. y *Delassor* spp., Homoptera Cercopidae) en Venezuela. I. Historia del insecto en el país.** [Contributions to the Study of Blight (*Aeneolamia* spp. and *Delassor* spp.) in Venezuela. I. The History of the Insect in the Country.]—*Agron. trop.* **4** no. 3 pp. 151–161, 32 refs. Maracay, 1954. (With a Summary in English.)

Cercopids of the genera *Aeneolamia* and *Delassor* have become major pests of sugar-cane in Venezuela in recent years and also attack other graminaceous plants there [*cf. R.A.E.*, A **40** 389; **43** 223]. In this first part of a proposed series, the author reviews the literature on their occurrence, distribution and control, and gives a list of the species responsible for the damage.

Kern (F.). *Euetheola* (*Dyscinetus*) *bidentata* **Burm. (Coleoptera) nueva plaga de los cañamelares de Venezuela.** [*E. bidentata*, a new Pest of Sugar-cane in Venezuela.]—*Agron. trop.* **5** no. 1 pp. 27–29, 3 figs., 4 refs. Maracay, 1955. (With a Summary in English.)

The Dynastid, *Euethcola bidentata* (Burm.), which is a well-known pest of rice and maize in Venezuela, was observed for the first time attacking sugar-cane there in Carabobo, in June 1955 [*cf. R.A.E.*, A **44** 395]. The adults cut the young shoots of newly planted cane at the base, below the surface of the soil, causing yellowing and drying up of the leaves. Low-lying, damp soils were preferred. The adults generally appear in late May and live for 20–30 days; they survived in the laboratory for 20–45 days.

Fennah (R. G.). **The Epidemiology of Cacao-thrips on Cacao in Trinidad.** —*Rep. Cacao Res. Trinidad 1954* pp. 7–26, 12 figs., 26 refs. St. Augustine, Trinidad, 1955.

This study of the factors that favour the development of outbreaks of *Selenothrips rubrocinctus* (Giard) on cacao in Trinidad is based on field

observations and a critical study of the literature. Population counts on leaves from two sites differing topographically showed that, during September–March, old leaves and unhardened leaves of the apical flush on the lateral branches and on young chupons after jorquetting are uninfested, fully hardened leaves of the previous flush are heavily attacked, and those of the one before are sometimes infested, though always less heavily. Old leaves are not attacked. On watershoots, the leaves show a regular gradation in age from top to bottom, and this may be accompanied by a corresponding gradation of increasing intensity of infestation. Attack is severe on the upper and outermost leaves of unshaded cacao, but is sometimes significantly less on the upper parts of slightly shaded cacao than on the lower parts. All stages of *S. rubrocinctus* also occur on the pods, but only well developed pods are liable to heavy infestation. Observations on other food-plants showed that the thrips was distributed sparsely on all the leaves of *Bixa orellana* after November, when only mature foliage was present, and was abundant on the mature foliage and the oldest leaves of watershoots of cashew in January. Peak infestation of cacao (in 1949) occurred at about the same date in several different localities. On leaves of the June flush, infestation developed moderately after mid-August, reached a peak in October and died out before November. Leaves of the September flush were heavily attacked in October, and maximum density on them was much higher than on the older leaves, but the population fell to a low level before December. Leaves of the February flush were attacked as soon as they began to harden, and substantial populations developed on them. The thrips wandered freely over the leaves before and at the peak of infestation, but later were relatively scarce and tended to remain in groups under small webs made by spiders or other arthropods; the protection from parasitic fungi and predators [*cf.* *R.A.E.*, A **32** 80] thus afforded probably accounted for their survival. The findings of earlier workers indicated some association between severe infestation and heavy rainfall, but this is probably dependent on soil type.

Since heavily infested trees often occur in small groups and have a history of exceptional damage, incidence at a single site was investigated among lightly shaded trees comprising five replicates of a clonal series but not containing any serious pocket of infestation. Estimates in October of the total infestation to which each tree had been subjected since June and of the current infestation and a further survey in late February indicated that the relative severity of attack on each tree remained constant. Significant differences were noted between the susceptibility to attack of trees belonging to different clones in experimental and other plantings [*cf.* **32** 26]; the relative standing of two clones widely used for replanting was maintained under very diverse soil conditions. Incidence was negatively correlated with tree vigour, as expressed by girth of trunk or main limb, branching habit and leaf density, and also with yield, and the correlation with the latter was highly significant. Infestation has frequently been stated to be more severe under exposed conditions [*cf.* **10** 280; **31** 148], but many exceptions to this were observed, and it is suggested that a correlation between incidence and light may depend on other factors, such as the water balance of the tree. McDonald postulated a relation between low available soil moisture and maximal increase in thrips population. Relative humidity in cacao fields in Trinidad normally ranges from 65 to 100 per cent., but is always high at night. *S. rubrocinctus* bred in a glasshouse where the relative humidity during the day was commonly close to 45 per cent., and the author considers that there is no direct evidence that low humidity is unfavourable for its development [*cf.* **27** 24].

In experimental plantings, the use of nitrogenous fertilisers was accompanied by a significant increase in infestation, whereas potassium fertilisers had no effect; McDonald found a higher ratio of nitrogen to potassium in

infested than in uninfested cacao leaves, and F. Hardy pointed out that leaf protein is more prone to extensive breakdown where potassium is relatively deficient. Soluble nitrogenous compounds were found to be more abundant in infested leaves from shaded watershoots than in uninfested young, but mature, leaves from higher up the tree.

From a consideration of these data and the literature, the author concludes that *S. rubrocinctus* is not a primary pest of cacao [*cf.* **10** 280] and that its presence and, to some extent, its abundance are determined by the physiological condition of the trees. Its annual increase on cacao in Trinidad is determined primarily by the increasing availability, as the wet season progresses, of foliage in a condition suitable for food. This condition is thought to be associated primarily with retarded synthesis of soluble nitrogenous compounds and an enfeebled protein-stabilising mechanism, resulting from the translocation of potassium from the leaves to the developing pods and the depletion of the potassium and other metallic nutrients present in the soil in a form available to the plant during the dry season (February–April). It is postulated that a single incision of such leaf tissue will yield a greater supply of food in solution than a single incision of a leaf in which protein synthesis is not retarded and the protein-stabilising mechanism is functional to its highest degree, and that multiplication by *S. rubrocinctus* at its highest rate can take place only under optimum feeding conditions.

Kirkpatrick (T. W.). **Notes on minor Insect Pests of Cacao in Trinidad. Part 3. Aphididae.**—*Rep. Cacao Res. Trinidad 1954* pp. 56–57, 5 refs. St. Augustine, Trinidad, 1955.

The Aphids dealt with in this part of a series [*cf. R.A.E.*, A **44** 325] are *Toxoptera aurantii* (Boy.), which is the only one commonly found on cacao in Trinidad and which occasionally causes distortion and wilting of the flush leaves on a few trees, and *Aphis craccivora* Koch, which has not caused any appreciable injury to cacao, but often severely damages *Gliricidia sepium* and may occur on cacao trees shaded by it. Descriptions of the apterous and alate viviparae of both Aphids and notes on their bionomics, abundance and natural enemies [*cf.* **43** 13] are included. No other Aphids attack cacao in Trinidad.

Kido (H.) & Stafford (E. M.). **The Biology of the Grape Bud Mite *Eriophyes vitis* (Pgst.).**—*Hilgardia* **24** no. 6 pp. 119–142, 6 figs., 25 refs. Berkeley, Cal., 1955.

The seasonal activity of the bud-mite strain of *Eriophyes vitis* (Pgst.) on vines [*cf. R.A.E.*, A **39** 447] was recorded from observations on buds at Davis, California, made weekly from August 1950 to August 1951 and then monthly until December 1951. The mites overwintered in the buds, mainly as adult females, and oviposition began in late March and increased rapidly as the weather grew warmer and the buds began to swell. Many mites and eggs were carried up on the inner bud scales that formed the stipular scales on the elongating shoots, and the newly formed buds were soon infested; other mites crawled along the canes. Progressively deeper penetration of the buds occurred from May to December. The primordial clusters in the centre of the buds were first observed to be infested in September in 1950 and in July in 1951, and increasing numbers of such clusters became infested until December. Infestation was heaviest in the first ten basal buds, the seventh containing the largest numbers of mites and eggs throughout the season. Oviposition reached a peak in July and fell to a low level with the approach

of winter, and the total population steadily declined from December to March, owing to this low egg-production and high mortality of the overwintering mites, so that the proportion of bud scales infested was low from February to early April.

On spurs cut from vines in the field and grown in the laboratory, the general symptoms caused by the mites were deformation of the primordial clusters, distortion of the basal leaves, stunting of the main growing points of the buds and death of the overwintering buds [*cf. loc. cit.*]. Evaluation of damage in the field is difficult, especially in the presence of abnormal growth caused by other pests or diseases, and a field experiment showed no relation between the number of infested buds and growth symptoms or yield. The most serious injury caused by the mite is to the growing points of the buds, but the extent to which this causes loss of yield varies considerably, depending on the fruiting habit of the vine variety.

Typhlodromus pomi (Parrott) was observed on the outer bud scales feeding on the mites but is apparently unable to penetrate into the buds, so that little control would result except in spring, when the mites are exposed on the stipular scales or leaf axils. No chemical compound has been found that will penetrate the buds and kill the mites without affecting the growing point.

Barnes (M. M.), Ash (C. R.) & Deal (A. S.). **Ground Pearls on Grape Roots. Subterranean Scale Insect known to infest Roots of Bermudagrass found established in Imperial Valley.**—*Calif. Agric.* **8** no. 12 pp. 5, 10, 3 figs. Berkeley, Cal., 1954.

Attention is drawn to the finding of *Margarodes meridionalis* Morr. on the roots of grape vines and Bermuda grass [*Cynodon dactylon*] in the Imperial Valley, California. The Coccid had not previously been recorded so far to the west in the United States, but had apparently been established for many years. The female deposits over 100 eggs, and the crawlers hatched between late June and late July in 1954.

Clarke (J. F. G.). *Eustalodes anthivora* (**Gelechiidae, Lepidoptera**), **a new Pest of** *Achras sapota* **in the Philippines.**—*Philipp. Agric.* **37** no. 8 pp. 450–451, 1 pl. Los Baños, 1954.

del Rosario (M. S. E.) & Cendaña (S. M.). **Bionomics of** *Eustalodes anthivora* **Clarke, Gelechiidae, Lepidoptera.**—*T. c.* pp. 455–469, 1 pl., 1 graph, 2 refs.

In the first of these papers, descriptions are given of the adults of both sexes of *Eustalodes anthivora*, sp. n. In the second, all stages are described, and it is stated that the larvae feed in the young ovaries of *Achras zapota* in the Philippines, causing the flowers to fall and preventing fruit setting. Laboratory investigations, continued from December 1952 to January 1954, showed that the egg, larval and pupal and total developmental periods last 2–5, 9–15, 3–7 and 16–24 days, respectively. The adults lived for 10–25 days, and the females laid 55–134 eggs each, singly or in groups of 2–5, on the petioles or peduncles; 40–96 per cent. of the eggs hatched. The moths are nocturnal and breed at any time of year; they did not seem to be attracted to white light. The larvae were parasitised by two unidentified Hymenoptera. Only *A. zapota* was attacked in the field, where the percentage infestation was 59–80 in December–June, when rainfall was low and the trees had many flowers, and 27–43 in July–November, when rainfall was heavy.

In laboratory tests, atomised sprays containing 0·13 per cent. DDT, 0·15 per cent. methoxy-DDT (methoxychlor) or 0·024 per cent. dieldrin killed all larvae in infested flowers in 24 hours, the first being the most rapid in action. Larvae did not enter flowers that had already been sprayed with these materials. In the field, the three treatments, applied on 9th May, 25th July or 26th September 1953, increased the percentage fruit set from 12·83 to 66·62, 47·15 and 60·64, respectively, but slightly injured tender leaves and flowers.

Johnson (C. G.) & Taylor (L. R.). **The Measurement of Insect Density in the Air. Part I.**—*Lab. Pract.* **4** no. 5 pp. 187–192, 6 figs., 27 refs. London, 1955. **Part II.**—*T. c.* no. 6 pp. 235–239, 7 figs., 5 refs.

Details are given of suction traps developed at Rothamsted for the study of the aerial dispersal of small insects, especially Aphids, at altitudes ranging up to several thousand feet [*cf. R.A.E.*, A **44** 46].

Paradis (R. O.). **Cycle évolutif du tétranyque à deux points,** *Tetranychus bimaculatus* **Harvey (Acari: Tetranychidae), dans le sud-ouest du Québec.**—*Nat. canad.* **82** no. 1 pp. 5–30, 7 figs., 4 graphs, 22 refs. Quebec, 1955. (With a Summary in English.)

Tetranychus telarius (L.) (*bimaculatus* Harvey) was observed for the first time in Quebec on apple near Montreal in 1947, and was subsequently found infesting many other plants. Laboratory and field studies on its bionomics on apple in 1950–51 showed that it has 5–6 generations a year. The females laid an average of 51·7 eggs each in about 17·5 days. The egg and nymphal stages lasted 3–24 and 5–31 days, respectively, depending largely on temperature, and the adult females overwintered. Reproduction was usually bisexual, but females were twice as numerous as males. The mites were attacked by various predators, of which the most important were *Typhlodromus fallacis* (Garman), *Haplothrips faurei* Hood and *Adalia bipunctata* (L.).

Allen (W. R.) & Askew (W. L.). **Toxicities of certain Insecticides to the Sweetclover Weevil,** *Sitona cylindricollis* **Fahr. (Coleoptera: Curculionidae), and the Protection of Seedling Crops.**—*Canad. J. agric. Sci.* **35** no. 4 pp. 344–349, 8 refs. Ottawa, 1955.

Overwintered adults of *Sitona cylindricollis* Fhs. caused serious damage to seedling sweet clover [*Melilotus*] in Manitoba during cool, wet weather between 8th and 18th May 1953, populations of 19 weevils per sq. ft. completely destroying 45 per cent. of an excellent stand growing within 50 yards of the site of a seedling crop that had been destroyed in the previous August, and populations of three weevils per sq. ft. reducing the rest of the stand by half.

Further field and laboratory tests on control [*cf. R.A.E.*, A **44** 271] were carried out later in the year. In the laboratory, batches of 20 adults anaesthetised with carbon dioxide were exposed on filter paper in a spray tower to emulsion sprays, and the percentage mortalities were calculated by Abbott's formula [*cf.* **13** 331] after three days, during which the weevils were kept at 21°C. [69·8°F.] and 64 per cent. relative humidity with fresh food. The materials tested, with (in brackets) the median lethal dose

expressed as mmg. per sq. cm. for each, were parathion (0·9), heptachlor (1·15), dieldrin (1·26), DDT (1·59), malathion (1·71) and toxaphene (6·08).

In the field, low-volume sprays prepared from emulsion concentrates of 30·7 per cent. Metacide [parathion and methyl-parathion], 25 per cent. heptachlor, parathion or DDT, and 18·5 per cent. dieldrin were applied to plots of sweet clover on 8th June, when half the seedlings had appeared. Metacide was used at 1 and 0·5 lb. toxicant per acre, DDT at 1·5 lb. and the others at 0·5 lb., and mortalities among weevils caged on the plots eight hours after treatment were assessed by Abbott's formula after four days. Dieldrin gave complete control, Metacide and parathion 98–99 per cent., heptachlor 93 per cent. and DDT 91 per cent. Three weeks after treatment, when weevils had entered naturally, the average number per sq. ft. was 0·6 on the plot sprayed with dieldrin and ranged, among the others, from 3·4 for 1 lb. Metacide and parathion to 4·2 for heptachlor, as compared with 3·8 for no treatment. After a further two weeks, population ranged from 2 per sq. ft. for dieldrin to 5 for 1 lb. Metacide, as compared with 1·4. The number of seedlings remained constant over the five-week period in the plot sprayed with dieldrin and increased in plots sprayed with 1 lb. Metacide and heptachlor. Over the same period, the percentage of seedlings on which half the leaves were destroyed by the weevil decreased in all the plots, the greatest reductions being from 51 to 0 in the plot sprayed with dieldrin and from 95 to 15 in that sprayed with parathion. The number and dry weight of plants in samples each comprising ten one-yard lengths of drill row were compared on 27th July. There were significantly more plants in the plots treated with dieldrin, heptachlor, DDT and parathion, where the numbers averaged 441, 388, 361 and 360, respectively, than in the untreated plot, where they averaged 276, and the total dry weight of plants in plots treated with these materials and with 1 lb. Metacide was significantly greater than that of plants in the untreated plot.

McGugan (B. M.). **Certain Host-Parasite Relationships involving the Spruce Budworm.**—*Canad. Ent.* **87** no. 4 pp. 178–187, 3 figs., 8 refs. Ottawa, 1955.

During investigations in northern Ontario in 1946–50 on the parasite complex attacking the spruce budworm [*Choristoneura fumiferana* (Clem.)], larvae and pupae of this insect were collected each year at four specific periods of development and reared in the laboratory, and larvae or pupae collected at two-day intervals during June in 1948 and 1949 were dissected and examined for parasites. The parasites considered are *Apanteles fumiferanae* Vier., *Glypta fumiferanae* (Vier.) and *Meteorus trachynotus* Vier., which attack the larvae, and *Apechthis ontario* (Cress.), *Itoplectis conquisitor* (Say) and *Phaeogenes hariolus* (Cress.), which attack the pupae, though others were obtained. The sex ratio varied from year to year in the larval parasites, females preponderating slightly, but was fairly constant for *Meteorus*. In general, females also preponderated slightly among the pupal parasites, but the proportion decreased from year to year as the population of *C. fumiferana* declined. A correlation between the sex of the host and of the parasite emerging from it [*cf. R.A.E.*, A **27** 499] was significant in *Apechthis* and highly significant in *Phaeogenes*; male parasites tended to emerge from male hosts and female parasites from female hosts, and this is possibly a response to host size, since female pupae of *C. fumiferana* are somewhat larger than male. Larvae of *Apanteles* emerged primarily from host larvae in the fourth and fifth instars, those of *Glypta* from hosts apparently in the fifth and sixth instars and *Meteorus* almost exclusively from sixth-instar larvae. The presence of *Apanteles* or *Glypta* inhibits the development of

the gonads of male hosts, thereby invalidating a sexing technique based on external inspection, and retards the rate of development of the hosts so much that the parasites were still emerging from them at a time when unparasitised larvae had already pupated. Furthermore, the head capsules of parasitised larvae, especially of those in the later instars, were smaller than those of unparasitised individuals [*cf.* **40** 162] to a highly significant degree, and the normal sex difference in this character [**44** 228] was eliminated. These effects were most intense in larvae parasitised by *Apanteles* and least so in those parasitised by *Meteorus*, which attacks them in the late fifth or early sixth instar. Small retarded larvae are readily overlooked in field samples, and this seriously affects appraisal of these parasites as natural control agents and complicates the timing of aerial spray operations, which is usually based on the frequency of the larval instars in periodic samples. Larvae parasitised by *Meteorus* survive for a week or more after the parasite leaves them but they do not pupate, and were still present when adults of *C. fumiferana* were emerging.

Phyto-Sanitary Convention for Africa South of the Sahara. London, July 29, 1954. [*In English and French.*]—*Treaty Series* no. 31 (1956) (Cmd. 9834) 11 pp. London, H.M. Stationery Office, 1956. Price 8*d*.

This convention, which was signed by representatives of the governments of Belgium, France, Portugal, the Federation of Rhodesia and Nyasaland, South Africa and the United Kingdom, provides for the establishment of a permanent commission to be known as the Inter-African Phyto-Sanitary Commission, on which participating governments are to be represented. Its functions are to seek information and recommend action to prevent the introduction of diseases, insect pests and other enemies of plants into any part of Africa south of the Sahara, to eradicate or control those already present, and to prevent their spread. The Commission is to appoint a Scientific Secretary * to ensure liaison between the Commission, the participating governments and the Commission for Technical Co-operation in Africa South of the Sahara, to prepare and circulate an annual report, and to represent the Commission at international meetings and on a Permanent Committee of Information of which the other members are the Directors of the Commonwealth Institute of Entomology and the Commonwealth Mycological Institute. The participating governments agree to exercise such control of plant imports and to take such action for effectively dealing with diseases and pests in the area concerned as are considered necessary by the Commission. The Convention has been ratified by five governments and came into force on 15th June 1956.

Haarer (A. E.). **Modern Coffee Production.**—10 × 6 ins., xiv + 467 pp., col. frontis., 75 pls., 38 figs., many refs. London, Leonard Hill (Books) Ltd., 1956. Price £2 16*s*.

This monograph on all aspects of the cultivation and production of coffee is based largely on the author's experience in East Africa. It includes a chapter on pests (pp. 298–327), in which information is given on insects and other invertebrates that infest the tree in various parts of the world, with references to the literature on them. Attention is devoted largely to bionomics and control, including natural enemies and the use of chemical

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measures, and the danger is emphasised of applying insecticides under conditions such as those of East Africa, where they may upset the natural balance and prejudice useful parasites.

Johnston (H. B.). **Annotated Catalogue of African Grasshoppers.**—$10\frac{1}{4} \times 6\frac{1}{2}$ ins., xxii + 833 pp., 37 pp. refs. Cambridge, Univ. Pr., 1956. Price £5 5*s*.

The families included in this catalogue, which is published for the Anti-locust Research Centre, are the Acridids, Eumastacids and Pneumorids, and the area covered by it is continental Africa with the adjacent islands of the Atlantic and the Indian Ocean. The information given under individual species includes the type locality, the whereabouts of the type specimens, and a list of references to the literature with indications of that dealing with morphology, taxonomy, synonymy, distribution, ecology, bionomics and, where appropriate, economic importance. References to keys to species and subspecies are also included. Only purely taxonomic and faunistic references are quoted for the swarming locusts, in view of the size of the literature on them. Species of which the taxonomic position is not determinable, species erroneously or doubtfully recorded from Africa and *nomina nuda* are listed in appendices.

Mallamaire (A.). **Les Homoptères nuisibles aux plantes utiles en Afrique occidentale.**—*Bull. Prot. Vég. A.O.F.* 1954 no. 2 pp. 91–153, 43 figs., 32 refs. Dakar, 1954. **Catalogue des principaux insectes, nématodes, myriapodes et acariens nuisibles aux plantes cultivées en Afrique occidentale française et au Togo.**—*Op. cit.* 1955 no. 1–2 pp. 23–60 [1956]. **Les principaux insectes foreurs des tiges, rameaux ou stipes des plantes cultivées dans l'ouest africain.**—*T. c.* pp. 61–100, 26 figs., 24 refs. **Les tétranyques en Afrique occidentale.**—*T. c.* pp. 101–109, 3 figs., 7 refs.

In the first paper, lists are given of the principal species of Homoptera that attack cultivated and other useful plants in French West Africa, with notes on their food-plants and on the morphology, bionomics and distribution of some of them, of the more important Coccinellids and Syrphids that are predacious on the Aphids and Coccids, and of the Hymenoptera that parasitise the Coccids and the fungi that infest them. In 1954, about a thousand examples of *Rodolia* (*Vedalia*) *cardinalis* (Muls.) were liberated near Dakar for the control of *Icerya* (*Pericerya*) *purchasi* Mask., which attacks *Citrus* and ornamental plants there. The chemical control of Aphids and Coccids is briefly reviewed.

The second paper comprises tables, arranged under the general headings of food crops, fruits, oil-bearing plants and industrial and textile crops, showing the principal Arthropod and nematode pests of the main crop plants and stored products in French West Africa and French Togoland, the parts of the plants attacked, and, in many cases, the type of damage caused.

In the third paper, a list is given of the more important species of Lepidoptera and Coleoptera that bore in the trunks, stems or branches of cultivated woody plants in French West Africa and cause damage of economic importance, with information on their food-plants and on the bionomics and distribution of some of them, followed by notes on cultural and chemical control measures. Good protection of young coffee from ovipositing females of *Bixadus sierricola* (White) was obtained in the Ivory Coast by painting the stems with emulsions containing 2·5 per cent. DDT

or 0·5 per cent. dieldrin, which retained their effectiveness for five and seven months, respectively.

In the fourth, the author reviews the appearance and bionomics of Tetranychid mites and states that the only two injurious species that have been identified from French West Africa are *Oligonychus pratensis* (Banks) (*Paratetranychus simplex* (Banks)), which attacks date palms in the oases of Mauritania, and *Tetranychus telarius* (L.) (*urticae* Koch), which infests vegetables and ornamental plants in Senegal. The chemical control of these mites is briefly reviewed.

Decelle (J.). **Un nouvel ennemi des** *Citrus*, *Distantiella collarti* **Schout.** (**Hemiptera-Capsidae-Bryocorinae**).—*Bull. agric. Congo belge* **46** no. 1 pp. 79–86, 6 figs., 7 refs. Brussels, 1955. (With a Summary in Flemish.)

Distantiella collarti (Schout.) was found on *Citrus* near Stanleyville, in the north-east of the Belgian Congo in 1952, and has since been observed in two other regions in that area. In July, 53 per cent. of the trees in a young plantation of about five acres were found to have been attacked, and 47 nymphs and adults were counted per 100 trees. All the species and varieties of *Citrus* represented in the plantation, including orange, mandarin orange and grapefruit, were attacked. Feeding resulted in damage similar to that produced on cacao by *Sahlbergella singularis* Hagl., which *D. collarti* closely resembles, consisting of lesions on the young twigs and branches, which were often subsequently invaded by fungi. The Mirid frequently punctured the twigs just below the young shoots, which broke off at that point or withered, shedding the leaves. Feeding occurred mainly at night, and one nymph was able to make 10–20 punctures on the shoots in the course of one night.

Walker (P. T.). **The Influence of Climate on an Outbreak of Wheat Aphid in Kenya.**—*Emp. J. exp. Agric.* **22** no. 88 pp. 293–304, 4 figs., 14 refs. Oxford, 1954.

The following is largely the author's summary. An account is given of an outbreak of *Toxoptera* (*Schizaphis*) *graminum* (Rond.) on wheat in Kenya in 1952 and the meteorological conditions associated with it and with a similar outbreak in 1911. Both were found to be most distinctly associated with high rainfall and mild conditions in the previous year and low rainfall just after sowing. Temperature was less important; it was higher and varied less than usual in late 1951 and remained unusually high throughout 1952, except for a month just after sowing. The probable recurrence of such conditions is calculated, and their bearing on Aphid numbers and dispersal is reviewed.

Papers noticed by Title only.

Costantino (G.). **La lotta contro la mosca delle olive** (*Dacus oleae*, **Gmel.), e i progressi realizzati segnatamente con l'uso dei prodotti organici di sintesi.** [The Control of the Olive Fly (*D. oleae*) in Italy and the Progress made, notably by the Use of synthetic organic Products (a review of the literature).]—95 pp., 50 figs., 94 refs. Catanzaro, Osserv. reg. Fitop.Calabria, 1955.

Fennah (R. G.). **Insects of Micronesia. Vol. 6 no. 3. Homoptera: Fulgoroidea.**—pp. [3+] 39–211, 64 figs., 1 map. Honolulu, Bishop Mus., 1956. [*Cf. R.A.E.*, A **43** 345; **44** 252.]

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